BULLETIN OF THE

TAYLOR SOCIETY

A SOCIETY TO PROMOTE THE SCIENCE OF MANAGEMENT

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IT IS POSSIBLE FOR THE APPLICATION OF METHODS LOOKING TOWARDS THE IMPROVEMENT OF MANAGEMENT TO BE GREATLY OVERDONE AND IT IS POSSIBLE FOR THEM TO BE DISASTROUSLY UNDERDONE. THIS LAST HAPPENS ESPECIALLY WHEN THE PROPRIETOR DEVELOPS A NEW DEPARTMENT FOR THE WORK MADE UP OF MEN WHO HAVE GROWN UP IN THE BUSINESS. THESE AMATEURS CATCH AT THE SKIRTS OF SCIENTIFIC MANAGEMENT AND GET ONLY PART OF ITS SPIRIT AND ITS ESSENTIAL METHODS . . . THE RESULT IS A GROTESQUE SUPERIMPOSING OF NEW THINGS ON OLD AND INADEQUATE FOUNDATIONS . . . A SORT OF VENEER OF THE NEW ART OF MANAGEMENT . . . PRE-TAYLOR METHODS DRESSED UP IN NEW AND EXPENSIVE GARMENTS. IF THE PROPRIETOR EMPLOYS AN OUTSIDE PROFESSIONAL INSTALLER HE MAY RUN INTO OPPOSITE DIFFICULTIES. THE PROFESSIONAL WILL USUALLY DO A BETTER JOB BECAUSE HE IS A PROFESSIONAL . . . BUT THERE ARE INCOMPETENTS IN THE PROFESSION . . . THE BEST MAY HAVE TOO MANY IRONS IN THE FIRE . . . SOME ARE DOCTRINAIRE . . . SOME LACK THE INSTINCT OF ECONOMY. Page 12.

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AUGUST, 1919 VOL. IV, No. 4

TAYLOR SOCIETY

ENGINEERING SOCIETIES BUILDING
29 WEST THIRTY-NINTH ST., NEW YORK

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OBJECTS OF THE SOCIETY

(Extract from the Constitution)

The objects of this Society are, through research, discussion, publication and other appropriate means:

1. To secure an understanding and intelligent direction of the principles governing organized effort for the accomplishment of industrial and other social purposes for the mutual benefit of
   - A. The Community
   - B. Labor
   - C. The Manager
   - D. The Employer

2. To secure the gradual elimination of unnecessary effort and of unduly burdensome toil in the accomplishment of the work of the world.

3. To promote the scientific study and teaching of the principles governing organized effort, and of the mechanisms of their adaptation and application under varying and changing conditions.

4. To promote general recognition of the fact that the evaluation and application of these principles and mechanisms are the mutual concern of the community, labor, the manager and the employer.

5. To inspire in labor, manager and employer a constant adherence to the highest ethical conception of their individual and collective social responsibility.

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THIS issue might properly be called the "Reprint Number" of the BULLETIN. All of the leading articles have appeared elsewhere—but in technical journals which come infrequently to the attention of members of this Society. The Society is particularly indebted to the American Economic Association, the American Statistical Association and the Storage Committee of the War Industries Board for these leading articles.

PROFESSOR Mixter's article on *Diminishing Returns in Manufactures* explains why the manager of a plant which is increasing in size and output—usually external evidence of prosperity—should give as serious attention to the problem of better management as the manager of the plant which is believed to be in trouble. Incidentally he makes some pertinent observations concerning management engineers. Mr. Crum's and Mr. Douglas' articles *On The Computation of Percentage of Labor Turnover* offer suggestions looking towards the adoption of a standard formula for the computation of a coefficient of labor turnover. Both criticise the method adopted by the National Conference of Employment Managers and apparently approved by the United States Bureau of Labor Statistics. The two parts of the article by Mr. Shelton on *Principles of Storage* were published as separate bulletins of the Storage Committee of the War Industries Board for the use of supply officers of the Army and of the Navy, and are here brought together for the first time.

INCLUDED in the story of the reorganization of the Society, in the Supplement to Vol. IV, No. 2 of the BULLETIN, was a list of possible services which the office of the Society might render on behalf of its members and of others interested in better management. It was not known along what lines activity should first begin. That was to be determined by the demands of those whom the office was intended to serve. It may interest the members to know that during the first three months, in addition to the work imposed by planning and editing the BULLETIN and planning and arranging for future meetings of the Society, the principal activity of the office has been, first, to act as an information center answering inquiries, personal and written, domestic and foreign, concerning "scientific management" and "Taylor management"; and, second, to act as an employment bureau, assisting firms in their search for persons who have had experience in good management or assisting men in their search for positions where they may study the principles and learn the art of good management. Disclosure of the line of service next to be emphasized by the nature of the demand for service is awaited with interest.

IS the manager, the consulting engineer in management, the industrial engineer, the management enneer, the consultant in management methods, or whatever he calls himself, really an *engineer* and a professional man? The question is raised in order to give occasion to inform our readers how it was answered by the American Society of Mechanical Engineers—a society which is exacting in its technical standards—over twelve years ago. We are permitted by the Secretary of the A. S. M. E. to state that in February, 1907, the Council of that Society, for the guidance of its membership committee, passed a resolution that "industrial engineering involving either the planning or management of important industrial operations.

shall be regarded as a branch of engineering, and as such forming a basis for qualification for admission to the grade of Member." This is recognition of the industrial manager and of the industrial engineer as engineers, with an implication in the words "basis for qualification" that the A. S. M. E. does not believe that everyone who appropriates for himself the titles in the first sentence of this paragraph becomes, by such appropriation merely, genuinely an engineer.

AGREEMENT on terms to define concepts is fundamental to the accurate exchange of ideas. There are perhaps no wastes greater than the wastes in discussion. Discussions, oral and printed, are carried on to interminable lengths because minds fail to meet; and in most instances minds fail to meet, not because of mental incapacity but because certain vital words, instruments of the exchange of key ideas, are inexact and confusing in their meaning. For instance, economists are troubled about the word *value*; it seems not to stand always for the same concept in their writings; so the suggestion has been made that that word and others to be coined (e. g., *val, valure, valurat*) be given definite, agreed-upon meanings. Among business men how many have the same concept when the word *executive* is used—or *administration, management, organization?* Some give *executive* the same meaning that others give *administrative,* and *administrative* the meaning the others give *executive.* In the minds of some the *management* is greater than and creates the *organization;* in the minds of others *organization* comes before *management,* the latter being merely the activities of the *organization.* It is time for a society which is continually using these words to venture to standardize the meaning of each. Mr. Schulze has yielded to the solicitation of the editor that he offer a few tentative definitions, which will be found on another page. It is hoped that every reader who disagrees with Mr. Schulze will send in his definitions.

READERS of *The Captains of Finance and the Engineers* on another page will undoubtedly be stimulated by Professor Veblen's keen analysis of the industrial system of the United States and of the dominant characteristics given our industrial life by the captains of industry. Some will immediately agree; some will immediately disagree; most readers will wish to test the generalizations by recalling what they have learned of our earlier and observed in our recent industrial life. They will be startled by the concluding suggestions. To the statement that the dominant influence of the captains of finance is now held on sufferance of the engineers they may give a reserved assent; but to the suggestion that the engineers permit nascent class-consciousness to develop into an organized guild for the purpose of exercising a balance of power in the struggle of industrial classes and of compelling a return to the motive of livelihood and of productive efficiency—we wonder if *that* suggestion may not provoke a few letters which will make interesting reading in the BULLETIN. Is it more startling to imagine a guild of engineers registering a demand to participate as principals in the settlement of policies on the higher plane of industrial-political policy determination, than it would have been five years ago to imagine the workers making a demand to participate in the settlement of policies on the plane of shop-policy determination? Professor Veblen is not the only one discovered harboring such ideas; in the correspondence columns of the *New York Times* have appeared a number of letters of the same general point of view.

ACCORDING to the *New York Times*—we have not yet received the report itself—a report of the National Industrial Conference Board concludes, after an investigation of the metal manufacturing industries, that it was impossible for "a considerable proportion of establishments to maintain production on a schedule of fifty hours a week;" that "of sixty-six establishments which reduced to a fifty-hour week, four reported production as increased, twenty-eight as maintained, and thirty-four as reduced." Concerning the forty-eight-hour week it says that if both management and workers would actively coöperate, such a week "might prove practicable in a larger number of establishments than is now the case. But unless such coöperation is secured there can be little question that the general adoption of the forty-eight-hour week in the metal trades would involve a serious economic loss to the nation." We wonder what is meant by the suggestion of coöperation between management and workers; there is not enough in this brief news item to make that clear. It usually means when used by manufacturers' associations that it is up to labor to do something unusual while the manager stands pat. All that is up to the worker in this particular industry is to perform in each of the reduced number of working hours a reasonable hour's work *in accordance with improved production methods*—and they usually manifest a willingness to do that. The big task of coöperation is up to the management. It is in the metal working industries of all industries that the possibilities of improved production methods have been amply demonstrated—improved production methods pertaining to the functions of management. Labor must coöperate by permitting improved management methods, but the problem is one which requires that management take the initiative. If practically fifty per cent of the plants in which any trial has been made in connection with the investigation could at least maintain production, we prophesy that with the introduction of real scientific management throughout the industry, the aggregate production of a forty-eight-hour week would show a startling surplus over the aggregate of the working week now prevalent.

SOME DEFINITIONS

IT seems desirable that managers should have in mind a universally understood concept when such a term as *organization, management, administration, executive,* etc., is employed in discussion.

The following attempt to lay down the basis for standard definitions of certain terms which seem now to lack standardization, made at the request of the editor, is not approached with any marked degree of confidence. The writer recognizes full well that he may be exposing himself to attack from various schools of thought. However, that is exactly the object sought. Someone must make a start in initiating discussion which may lead to official definitions of fundamental terms pertaining to management by an authoritative body, such as in the Taylor Society.

An organization is a combination of the necessary human beings, materials, tools, equipment, working space and appurtenances, brought together in systematic and effective correlation, to accomplish some desired object.

The very word ***organization*** implies more than one. More than one what? Is a group of people without equipment and material to be spoken of as an organization?

The writer concedes that the popular conception of the term usually has reference only to the human beings involved. This probably follows from the fact that the human beings form by far the most important factor—and, by the same token, the most difficult problem. Yet any group of people, no matter how skilled, would be impotent without the tools, equipment, and other paraphernalia mentioned in the definition, with which to do their work.

It may be argued that a group of people will create these things and that the material things are not essential because they invariably result from the group of people. The answer is, however, that not until these material things have been added can the personnel be regarded as an organization ready to perform the work laid out for them.

The mechanic's tools, bench and machinery; the office employe's desk and office appliances; the space which the people must occupy; the telephones, lighting system, electric buzzer system—yes, the stationery, forms and the like needed in the carrying on of their work—are all part of the organization. If they are not, then under what category do they belong?

The word *organization,* as the writer conceives it, is not satisfied with the mere existence of these factors. It assumes that they are brought together to form a whole, correlated with respect to an ultimate object. This correlation must be so systematic as to permit the object to be gained in an effective manner—that is, without the use of excessive energy.

Attention is directed to the word *permit.* It is used advisedly and is intended to signify that the organization itself is a human and physical mechanism which stands ready to accomplish the thing for the accomplishment of which it was created. It does not actually function, however, until management pulls the lever.

Management is the force which leads, guides, and directs an organization in the accomplishment of a pre-determined object.

Criticism may be made of the conception that management is a *force.* It is the writer's belief that management consists of more than an individual or a group of individuals who direct the destinies of an organization. It is these plus a spirit, an atmosphere, set of ideals, enthusiasm, inspiration, loyalty, orderliness, morality, humaneness, sympathy, discipline—it is each of these things and all of them together with their antitheses. The writer knows of no other word into which they can all be summed that is better than the word *force.*

This force, then, has the responsibility (the word *responsibility* also being used advisedly), not of accomplishing by and of itself the object sought, but of so leading and guiding and directing the organization entrusted to it, that, combined, the object is accomplished.

Some explanation should probably be given also to substantiate the use of the word *pre-determined.* The implication here is that management, if the conception in the above definition is accepted, does not necessarily concern itself with the nature of the ultimate goal. This goal may be set for it by higher authority, by circumstances, by trade practice. It is not of the essence of management that it select its own goal; although probably it is necessary that it satisfy itself that the goal is worth striving for, or otherwise some of the elements of management would be missing.

Administration is the force which lays down the object for which an organization and its management are to strive and the broad policies under which they are to operate.

The words *management* and *administration* are so frequently used synonymously that one rather hesitates to draw a distinction between them, for after all usage gives a word its meaning. Yet there is a conception in the minds of many of us giving the word *administration* a meaning broader than either *organization* or *management;* in fact, many of us look upon it as encompassing both.

Probably the form of our government is somewhat responsible for this conception. The president, who with his cabinet, is regarded from an organization and management point of view as the official elected by the people to lay down, year by year during his *administration,* the objectives toward which the country is to strive and the policies under which it is to operate, typifies the administrative force behind our government. His messages to congress and his proclamations to the public are administrative in their purpose. After the messages have resulted in congressional enactment and the proclamations have been issued, the various governmental heads of departments, typifying *management,* direct the governmental *organization* in the carrying out of the objects laid down in the acts of congress and the presidential proclamations.

In business, similarly, the board of directors fulfills the administrative function and is represented in its application by a general manager or a managing director—sometimes by an executive committee or board of control.

The terms *executive, organizer, manager, administrator* and the like also are lacking in definiteness in their daily use in practice. Acceptance of the above definitions would automatically define all these terms except *executive.* Thus:

An organizer is a person who brings into being an organization in accordance with the definition above given.

A manager is a person who leads, guides and directs an organization.

An administrator is a person who establishes general objective and policies.

Executive, in the writer's judgment, is a term synonymous with *manager.* That is to say, he is a person who directs and executes, as distinguished from a person who plans, studies and organizes.

There seems to be an inconsistency in the application of the term *chief executive* to the President of the United States, who is at the same time looked upon as the administrator. It would seem, as a matter of fact, that there is a duality of responsibility here; on the one hand, the presidential office is looked to for guidance from an administration standpoint; on the other hand, the president is held responsible for the execution of the various laws and acts passed by congress, by his own office and by the various governmental departments, each within their scope. This is not necessarily an inconsistency; it simply means that two functions are laid upon the shoulders of one individual. As a matter of fact, in a large measure the administrative function is of a recommendatory character only, the ultimate authority lying in congress. Thus it might be said that the responsibility for the administration of our government really lies in combination of president and congress and not in the president alone.

J. William Schulze

THE CAPTAINS OF FINANCE AND THE ENGINEERS

SOME fifteen years ago appeared a book by Thorstein Veblen entitled *The Theory of Business Enterprise.* It seemed to the editor at that time that this book—the first chapters particularly—presented a most searching analysis of the nature and interrelations of the governing motives and the developing mechanisms in American industrial life. The book attracted no particular attention at the time and it has not succeeded in doing so in the years which have followed. Possibly the American business man was too absorbed in the enterprise there analyzed to care about any analysis; possibly he was not ready for such strong medicine, for his *industrial constitutional troubles* were not as apparent to him as they have become since his *system* has been weakened by the exposures of war; probably the obscure style of the author made the medicine seem impossible. Such expressions as "the concatenation of industrial processes" do not go down easily.

With respect to the motives in American industrial life the author argued that the early motive of securing a livelihood had been replaced by the motive of making money. In the days when the dominant motive was livelihood, the craftsman, the small trader and the small shop earned income and sometimes accumulated wealth by producing—by adding useful attributes to material things or by rendering services which contributed to that end. In later days when the motive of making money became dominant, although many individuals and concerns continued to aim at livelihood, the characteristic thing, because far-reaching in its social consequences and giving tone to the whole—dominating the financial pages of the newspapers and the news concerning captains of industry—was the effort to secure wealth regardless of whether the effort resulted in an addition to the world's total of production. Stock watering, the manipulation of corporate securities, deceptive advertising and the buying of corporate franchises are noteworthy illustrations of the efforts inspired by the later motive.

Concurrently with the change in motive developed industrial mechanisms which facilitated the play of the wealth-getting desire. With increase of population, perfection of machine processes, greater command over natural resources, accumulation of capital and integration of markets, a system which represented primarily an organization of skilled craftsmen and tools was gradually replaced by one which represented an organization of mechanical processes and natural resources, to which the skilled workmen and tools became subsidiary. This organization of natural resources and mechanical processes ran to "quantity production" of specialized and standardized goods and services. It was made more complex and delicate by the development of a vast credit mechanism which was embarrassed by an archaic banking system. The corporate form of organization led gradually to the separation of management and ownership. The system became a body of diverse and interlocking processes, the due working of one part of which depended on the due working of the rest, and lent itself to systematic control under the direction of captains of industry. Systematic control led to systematic manipulation. The captains of industry of the eighties and nineties dominated industry and accumulated fortunes, not primarily by promoting technical productivity, but by disarranging the industrial system and manipulating values, by securing "rake-offs" made possible by substituting in the public mind artificial and varying values of corporate properties and enterprises for their real values.

While we believe that the great majority of businesses in the United States are still motived by the purpose of securing income through the creation of useful attributes in things and through the rendering of useful services—straight-forward production—, nevertheless, either because they have supported or have applauded or have been indifferent to the methods and policies of those motived by the wealth-getting desire only, they have become in the mind of the humble citizen, and particularly of the worker, blackened by the same tar as the manipulator of values. No little of the misunderstanding which has led to embarrassed industrial relations is due to the inability of the worker to distinguish one class from another. It would be the counsel of wisdom which could induce those engaged in legitimate productive enterprise to associate together and raise a banner and undertake an educational campaign to make clear for what they stand. Bonuses, profit-sharing, collective bargaining and shop committees alone will not accomplish all that is necessary; motive, methods and results must be made clear. All the cards must be laid on the table. The game will then become one of coöperating managers and workers against bogey, instead of each against the other as opponents.

Now comes the same author with a series of articles in *The Dial,* presenting the same general thesis, this time simpler in style and much more readable, and enhanced in effectiveness by references to developments of recent years which are well known to every business man. An article in the June number, the title of which has been made the caption of this editorial, is especially noteworthy.

In this particular article the general argument is that

> politics and investment are still allowed to decide matters of industrial policy which should plainly be left to the discretion of the general staff of production engineers driven by no commercial bias;

that the progressive advance of the industrial system

> appears to be approaching a critical pass, beyond which it will no longer be practicable to leave its control in the hands of business men working at cross purposes for private gain, or to entrust its continued administration to others than suitably trained technological experts, production engineers without a commercial interest.

It should be observed that Veblen uses the terms "business men" and "commercial" in a sense more restrictive than that in which they are ordinarily used. The shop superintendent, the production manager, the sales manager and the general manager are not "business men"—they are technologists; the "business man" is he who is outside of and above the operating personnel; he is engaged in the field of the larger industrial-political, financial-commercial strategy, studying and manipulating values on behalf of "vested interests," and concerned with production only as its advancement or repression will contribute to his larger purposes. The term "commercial" refers to these industrial-political-financial operations and not to the buying and selling of the technologist.

> But from an early point in the (industrial) development there set in a progressive differentiation such as to divide those who designed and administered the industrial processes from those others who designed and managed the commercial transactions and took care of the financial end. So there set in a corresponding division of powers between the business management and the technological experts. It became the work of the technologist to determine, on technological grounds, what could be done in the way of productive industry, and to contrive ways and means of doing it; but the business management always continued to decide on commercial grounds, how much work should be done and what kind and quality of goods and services should be produced; and the decision of the business management has always continued to be final, and has always set the limit beyond which production must not go.
>
> But the specialists in technological knowledge, abilities, interest and experience . . .—inventors, designers, chemists, mineralogists, soil experts, crop specialists, production managers and engineers of many kinds and denominations—have continued to be employees of the captains of industry, that is to say, of the captains of finance, whose work it has been to commercialize the knowledge and abilities of the industrial experts and turn them to account for their own gain.
>
> It is perhaps unnecessary to add the axiomatic corollary that the captains have always turned the technologists and their knowledge to account in this way only so far as it would serve their own commercial profit, not to the extent of their ability or to the limit set by the material circumstances or the needs of the community.
>
> The result has been, uniformly and as a matter of course, that the production of goods and services has advisedly been stopped short of productive capacity, by curtailment of output and by derangement of the productive system. . . They have . . . maintained prices at a profitable level by curtailment of output rather than by lowering production-cost per unit of output. . . The result has been . . . enforced incompetence in the management of industry, a curtailment of output below the needs of the community, below the productive capacity of the productive system, and below what an intelligent control of production would have made commercially profitable.
>
> One outcome of this persistent and pervasive tardiness and circumspection on the part of the captains has been an incredibly and increasingly uneconomical use of material resources, and an incredibly wasteful organization of equipment and man power in these great industries where the technological advance has been most marked.

This discreditable pass, Veblen says, has brought the regime of the captains of industry to a close and has shifted control to the syndicated investment bankers to whom has been passed the function of "regulating the rate and volume of output in those industrial enterprises" which have passed into their hands. The corporation financier (captain of industry of nineteenth century tradition) has become an "idle wheel in the economic mechanism, serving only to take up some of the lubricant." The engineers are the technological general staff of the industrial system, whose surveillance has become increasingly imperative to the conduct of any profitable enterprise in industry. But they have no control and take no initiative; and their technical advice is followed only insofar as it promotes the larger political-industrial strategy of the syndicated investment bankers. This is a complete development, of course, "only in those larger and pace-making lines of industry which are altogether of the new technological order," but throughout industry in general "the present posture and drift of things is unmistakable."

The industrial system requires the use of trained and instructed workmen and a corps of highly trained and specially gifted experts—born, bred and trained at the cost of the community at large. These experts are essential to the working of the industrial system. "Without them and their constant attention the industrial equipment, the mechanical appliances of industry, will foot up as just so much junk." To do their work as it should be done, these men should have a free hand. With a reasonably free hand "the production experts would today readily increase the ordinary output of industry by several fold,—variously estimated at some 300 per cent to 1200 per cent of the current output." Yet they are restricted by the owners through the syndicated investment bankers and by business as usual.

Of late these technologists, says Veblen, have begun to become "class-conscious" and to realize that they constitute an indispensable general staff of the industrial system. They realize the waste and confusion in the management of the financial agents. First the consulting engineers of the standard type began to "make scattered corrections in detail," but they are as yet no more than "a cross between a technological specialist and a commercial agent, with the limitations of both and commonly not fully competent in either line," employees of the investment banker, on a stipend or a retainer. The "efficiency engineers" have accomplished more but are in much the same position.

> Circumstances have decided that the older generation of the craft have become pretty well commercialized. Their habitual outlook has been shaped by a long and unbroken apprenticeship to the corporation financiers and the investment bankers. . . . But the new generation which has been coming on during the present century are not similarly true to that tradition of commercial engineering that makes the technological man an awestruck lieutenant of the captain of finance . . . they are beginning to understand that commercial expediency has nothing better to contribute to the engineers' work than so much lag, leak and friction. . . . So they are beginning to draw together on a common ground of understanding, as men who are concerned with the ways and means of tangible performance in the way of productive industry . . .—there is a growing conviction among them that they together constitute the sufficient and indispensable general staff of the mechanical industries, on whose unhindered teamwork depends the due working of the industrial system and therefore the material welfare of the civilized peoples.
>
> It would be hazardous to surmise how, how soon, on what provocation, and with what effect the guild of engineers are due to realize that they constitute a guild, and that the material fortunes of the civilized peoples already lie loose in their hands. But it is already sufficiently plain that the industrial conditions and the drift of conviction among engineers are drawing together to some such end.

In attempting to alleviate the continuing and increasing industrial unrest

> negotiations are continually carried on and never concluded between capital and labor, between the agents of the investors and the body of workmen, to bring about whatever readjustments are to be looked for in the control of productive industry and in the distribution and use of its product. . . . In the course of these endless negotiations between the owners and their workmen there has been some loose and provisional syndication of claims and forces on both sides; so that each of these two reorganized parties to the industrial controversy has come to make up a close-knit vested interest, and each speaks for its own special claim as a party in interest . . . hitherto no disinterested spokesman for the community at large or for the industrial system as a going concern has cut into this controversy between these contending vested interests.

Veblen concludes that the engineers are in a position to make the next move.

> So slight are their numbers, and so sharply defined and homogeneous is their class, that a sufficiently compact and inclusive organization of their forces should arrange itself almost as a matter of course, so soon as any appreciable proportion of them shall be moved by any common purpose. And the common purpose is not far to seek, in the all-prevading industrial confusion, obstruction, waste, and retardation which business as usual continually throws in their face. At the same time they are the leaders of the industrial personnel, the workmen, the officers of the line and the rank and file; and these are coming into a frame of mind to follow their leaders into any adventure that holds a promise of advancing the common good.
>
> So that, given time for due irritation, it should by no means come as a surprise if the guild of engineers are provoked to put their heads together . . . there is the patent fact that such a thing as a general strike of the technological specialists in industry need involve no more than a minute fraction of one per cent of the population; yet it would swiftly bring a collapse of the old order . . . the industrial relationship of the captain of finance is now held on sufferance of the engineers and is liable at any time to be discontinued at their discretion as a matter of convenience.

BUSINESS TRAINING FOR MILITARY OFFICERS

THE Taylor Society respectfully suggests that provision be made for adding to the technical training of West Point graduates, a training in business administration. When war is declared an immense burden of business negotiation and administration is at once thrown upon those officers who are assigned to the increasingly important procurement and supply functions. It may be expedient that regular officers be placed in charge of supply bureaus, of which the assistants are especially commissioned civilians experienced in business affairs, but the effectiveness of the latter has been proved to be conditioned by the breadth of view in business matters of the bureau chief.

That his business capacity is limited is not surprising. Appointed to West Point before he has had any contact with the world of affairs, he is given an extremely narrow technical training—relating to the designing of military equipment or to the technique of field operations. Then during the first quarter of a century after graduation, unless he happens to be a member of the engineer corps, his "experience" is limited to checking the paper work of, say, first a company and finally, at the ripe age of fifty, of a post at which is a regiment of troops. The routine paper work of a post does not afford training in business methods, in conducting business negotiations, in organizing and managing a war-time bureau office of a thousand civilian clerks, or in supervising and stimulating production on war-time contracts.

A course in business administration at West Point, special work at the Harvard School of Business Administration or the Tuck School, a period of service in manufacturing and merchandising concerns,—such additional training for future officers would profoundly influence the supply operations of another war.

DIMINISHING RETURNS IN MANUFACTURES[1]

By Charles W. Mixter[2]

THE classic writers, as is well known, excluded diminishing returns from direct operation in manufactures. The "limiting principle" in the extractive industries was the universal pace-setter for all economic society, and had its effect in manufactures only indirectly *via* increased cost of food and other raw materials. Even at the present day it is perhaps not generally appreciated that the law or principle of resistance which meets all expansion or extension of wealth-creating endeavor is universal. Unless the resistance is fully counteracted by invention or the improvement of the arts, we have diminishing returns along whatever line the increase of the scale of operations takes place.

One advantageous angle of approach to the problem of the "limiting principle" in manufactures is to ask the reason for the survival in the general competitive system of things of many small-scale industries, notably those engaged in producing high-grade, hand-made articles. The immediate answer (apart from considerations of the extent of the market) is that when such industries attempt large-scale operations their costs become too great relatively to the output. In a characteristically mechanical industry, on the other hand, the output is increased by the powers embodied in the machines sufficiently to overcome the increased costs, and hence with them a large scale of operations may be successful and permanent. The one class of businesses is in the way of realizing considerable improvements in the arts as they expand, because they have a great mass of machinery with which to make them. A business of the other class has conditions which do not lend themselves to increased powers of production, and hence the obstacle of increasing costs confines them to a small scale of undertaking.

The specific subject before us has been recently handled with a wealth of fresh illustration by Professor Dewing, in an article on "The Law of Balanced Return."[3] His analysis of the situation though searching, is not, however, complete. Besides "labor costs" and "capital costs" with respect to both the merchandising side and the plant side of a manufacturing business, there are also what may be called managerial costs. There is both plant proper "overhead" and management "overhead." When the small business of any sort, predominantly mechanical or predominantly hand work, multiplies its force of workmen and multiplies its equipment, stock of material, etc., managerial overhead mounts upward. This last is in the main what that "resistance" consists in which must be overcome by increasing productivities, if there is to be escape from diminishing returns or a shrinking to avoid bankruptcy to small-scale production again. I do not think that the proportion of labor cost to capital cost in the product has the significance that Professor Dewing attached to it. It does not work as positively as he assumes. The fact is, any business whatsoever will fail if it grows rapidly, and in so doing merely has recourse to "quantitative accretions" of labor and plant. The expanding overhead in that event will swamp it.

One of the most striking illustrations of his thesis in Professor Dewing's article is the one given (pp. 760-761), apparently from personal experience, of the case of the shoe manufacturer of long training and great success as a small-scale producer who failed utterly when he built a new and larger factory, but still made without change a "particular grade of shoe," presumably of the finer sort. He had the advantage of a much better equipped factory, we are told, a "show establishment" in place of one "rather antiquated and inefficient." He could not compete, however, with "smaller and technically less efficient factories," because they had compensating advantages in being smaller and set a price he could not meet. His own "fixed capital costs" per unit of product varied adversely after he enlarged; they became "so much greater proportionately to the cost of labor" as to be his undoing. The cost of labor did not vary, being governed before and after by the fixed piece-rate "scale" of his locality. Also during the experiment (for that is what is really before us), by implication, there was no trouble from an insufficient market for the product. The bankruptcy came not from bad debts or other increased selling costs, not from increased wages per man employed, but simply from the fact that under the great scale of operation "the fixed capital cost was too great for that particular line of product." Of course this may have been precisely so because our "highly successful" man, "spurred on by his success," like many another, lost his head and overdid his "show establishment" to a degree that made it technically less, not more, efficient than his old one. But we are not told that such was the case, and therefore we may rule it out. Rather there is one last fact that Professor Dewing does tell us (not last, of course, in the order of his presentation of the story) which may be taken as the key to the whole situation, and that is: "He exercised the same entrepreneur ability in both factories." That, I submit, was probably the difficulty. Not that he continued to make the same grade of shoes, but that he exercised "the same" entrepreneur ability. In his expanded business he had to exercise a new and different and improved entrepreneur ability. The resistance came; he had to meet it or go under. He wasn't necessarily doomed to bankruptcy because of the grade of his product or the scale of his operations.

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[1] Reprinted, by permission, from *American Economic Review*, Vol. VIII, No. 4 (Dec., 1918), pp. 741-751.

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[3] *American Economic Review*, Vol. VII (Dec., 1917), p. 755.

The present writer now has himself a very definite thesis to maintain. Just what happened in the larger shop that brought failure? Exactly in what did the "resistance" consist in this instance? We may answer concretely as to the strong probabilities drawing from the experience of many similar instances.

One of the first prevailing phenomena when a small shop grows into a large one is trouble with regard to inspection. "Inspection" does not mean merely the careful scrutiny of the finished product before shipment to maintain its "quality"; it means, rather, in any business where there is assembly of parts, the proper testing by standards—written standards—of the accuracy of all the operations that are performed on each of the parts preparatory to assembly, intermediate group assembly as well as final assembly. Moreover, at every stage of production, inspection means verifying the count as to quantity; otherwise the parts do not "match up" (shortages and excessive "overs"), though each be made perfectly. In these matters the practice of most small shops is exceedingly rudimentary. The ordinary workmen themselves are relied upon to be the primary inspectors all along the line, and the proprietor or his overworked foreman is the only over-inspector. There are, as a rule, no written standards—bills of material, drawings, or other specifications; these things the various persons responsible for production carry in their heads. Even if the specifications are written out to a degree they are not systematically written, recorded, and made universally available. Having this and that written on some paper hung on a nail somewhere, some leading workmen or foremen alone knowing where it is, is but once removed from having it in peoples' heads only. A very common practice is to go by "samples" instead of blueprints, and to refer to things in the manufacturing orders by name only rather than by definition of size, and to omit description of quality and quantity of material. It is always rough work, with numerous "fall downs" in several ways, that is done with respect to specifications by using "samples."

These crude devices answer as long as the business is small so that the eye of the proprietor oversees everything, and so long as he has "experienced" workmen and foremen who know all the little ins and outs of the processes; but as soon as expansion comes on this basis, comes trouble—serious trouble. Strangers are taken into the workrooms and they have difficulty in finding out what is expected of them. Even after they do find out they naturally give themselves the favor of the doubt as regards the execution. It is fundamentally wrong in principle for those who make things and are primarily responsible for volume of output, themselves to pass upon the doubtful points as to how well they have made them. Consequently, as soon as the little old-style, unified shop expands into a large, complex shop there is a shifting of responsibility all along the line and back again as regards matters involving the function of inspection. The proprietor tries to mend matters by promulgating rules and putting pressure upon individuals. He is slow to change the method of inspection; and if he does change it, that means hiring inspectors as such and an elaboration of his clerical procedure, which costs money. The proprietor is confronted obviously by a dilemma. One way he meets with increased costs through delays in production and postponed deliveries and also through increase of work that has to be done over and increase of wholly spoiled material; the other way he meets with increased costs to keep these things down. Professor Dewing seems to assume that the increased cost will come in the first form—that the proprietor will not be able to surmount the difficulties of "final inspection" even, and the increase of "seconds" shipped will ruin the goodwill and so the business.

The point I wish to emphasize here is that, even when difficulties of inspection are surmounted, it costs money to do it, and there is, comparatively speaking, no way to get that money in the case of a hand-made, competitive product. If 500 workmen are employed where only 50 were formerly, then productivity increases approximately only in the ratio of 1 to 10, and the managerial overhead, for the function of inspection alone, increases in some greater ratio. It is manifestly more per workman employed, or per unit of product, if the explanation of the situation advanced above is sound.

But the business which is predominantly machine using (even a large and formerly successful one, too) often meets with serious difficulty on the score of inspection if it seeks to expand rapidly or, more especially, undertakes the manufacture of a new product. It is well known in engineering circles that it was precisely from this cause that many of the recent rapid expansions in war-order work resulted in small profits or no profits at all. Most concerns of all sorts and sizes are weak in the matter of dealing systematically with specifications, and there can be no proper inspection without an adequate handling of specifications. Specifications is a long word, and it is a long job getting them to meet fully all requirements. Having full specifications means deciding most searchingly, down to the minutest detail—nothing overlooked—all the questions pertaining to what you are going to make. Incredible as it may seem, this first question of all in production is frequently left unanswered before the task of production is begun. Men enter into contracts for millions of dollars' worth of shrapnel, for example; start the work, and even complete the shells, and *then* find out what are the specifications. This sort of thing both in peace times and in war times, is the reason for many a failure large and small in manufacturing.

Before leaving this topic it is to be observed that, on the other hand, it is waste, and great waste, to have specifications which are too fine. Only men of wide manufacturing experience can fully appreciate the extent of the loss, for example, from working machined metal parts to limits of a thousandth of an inch when limits of a hundredth of an inch would amply suffice. And in general there is great loss from over-elaborated and over-specific requirements. The purchaser should state clearly in his order the purpose of the product and the essential tests to which it must conform, and leave to the judgment of the experienced manufacturer the non-essential details of construction and methods of manufacture. There can be no proper economy in production otherwise. Governments are especial offenders in this particular matter, but it is common throughout all industry. This topic has such a direct bearing upon the leading idea of this article, the determination and observance of the does-not-pay point, that if space permitted it might well be elaborated. In passing, however, I will merely state that it is indeed a profound truth (the principle applicable to all the arts) that "Good enough is first-class engineering."

But to return to the case of Professor Dewing's small hand-product shoe manufacturer who undertook to swell like the proverbial frog and burst. What really happened that caused the catastrophe? Besides troubles connected with inspection resting on omitted or incomplete specifications, he also doubtless had his troubles with "control of materials." As long as everything goes on under the eye of the master, he keeps track well enough of stocks of materials which are getting low, both raw materials and partly manufactured parts. If a particular customer's order calls for an exceptionally large quantity of a certain material, he anticipates that irregularity in the "usage" and orders a sufficient supply in time; but once his shop grows into several semi-autonomous departments or "rooms," and he continues his old methods (as he usually does), he never again knows how he is situated. Each foreman has his own stock or reserve of materials, raw and partly finished, and even he usually knows only approximately what is in that stock. Things are constantly being bought or made which are on hand already. Moreover, there is loss from jobs being held up and from deliveries delayed by reason of every now and then being out of this and that material. If interruptions of production are avoided by carrying larger stocks, and at least knowing where things may be found, it means a greater investment for a given volume of output, and diminished profits. Under unsystematized control of material and inadequate routing the amount of "work in process" also, as distinguished from materials proper in stock, grows amazingly, and, in turn, makes the turn-over slow and lessens the profits. If our small manufacturer who has expanded into a large manufacturer intelligently seeks to avoid bankruptcy from this set of causes impelling toward bankruptcy, it can be only through installing a proper stores system with written "issues," "balance sheets," and "apportioning" (the device of stock room "limits" will not answer if there is irregularity in the usage). All of this costs money, means a considerable increase of managerial overhead; and where is the money to come from to pay for it? So, unless he reverses his policy and curtails operations, bankruptcy is apt to come anyhow.

And the large business has this same sort of resistance to contend with also. The present writer knows of a large clock manufacturing concern which at one time had somewhere around a million dollars invested in stocks of material and parts (a large proportion junk) and yet was constantly making up fresh quantities of things it had already. The stores of this concern were scattered in all sorts of places, with no proper records of them, and many of them were, consequently, for all practical purposes lost or non-existent, except for the burden of investment. The "work in process" in some of the work rooms was piled to the ceiling and so congested the place that the workmen could hardly get in or out. In every manufacturing concern, old or new, large or small, the problem of control of material in its entirety—having things dependably where wanted at the time they are wanted—is far more difficult than the layman conceives. It is difficult to preserve a proper balance between different sorts of material, proper to varying usage and varying supply periods, that is, varying conditions of delivery by the suppliers. As regards specific "worked material," it is difficult to strike the balance between direct, technical economy in production and the indirect economy of the usage requirements. It is difficult beyond the imagination of the layman, even when the general balance of stores is economically maintained, to get the stores from the stores room to the machines regularly and without fall-down. There is the great problem of waste and the handling of necessary "excess issues" of all sorts, moreover, but I have no space to go into that.

Finally, let us consider briefly what happens with respect to the system of manufacturing orders and the hiring and discipline of the help, and the "organization" generally, when a small concern with hand-made product or machine-made product grows into a large concern. As long as the shop remains small, a crude system of command suffices. Most of the orders are given orally and executed by rule-of-thumb as to sequence and quantities. But what is chiefly before us now is the matter of organization, delegation of duties, placing of responsibility, the seeing to it that responsibility and authority coincide—the whole subject of control of men.

In most old-fashioned shops, large and small, the supreme government does not obey its own laws. An order, perchance reduced to writing, defining functions and responsibilities so that friction may be avoided and team play secured, is hardly issued before it is disregarded by the boss himself. The only way such a system works (and it does work in a small shop) is that despotism is tempered by disobedience all along the line. Much of what the "old man" orders is treated by his subordinates "with a wise and salutary neglect." They know the old man and they know the relative importance of things—what must be done and what need not be done. Contrariwise, the old man knows his men, and as long as he can directly oversee them, makes allowances for excusable fall-downs. He has, of course, at least fairly good judgment about men and processes, else he would not be the proprietor of even a small shop. He does not accordingly, discharge a man without sufficient cause, knowing well that, as a rule, the man he will get in his place will have the same or other natural failings, and, besides, there will be the time and cost of breaking him in to a useful knowledge of the habits and kinks of the shop.

But as soon as our benevolent and sagacious despot has to trust to lesser despots (often not so benevolent and sagacious) and cannot, because of the general growth of the business, directly supervise things as before, the whole crude scheme of organization and control of the human element falls to pieces. The loss from excessive labor turnover presently becomes very great; or, on the other hand, the labor turnover may continue small because bad workmen are allowed to stay under poor discipline. From excessive zeal for discipline (supported by absurd rules) or from undue slackness, either way the master is badly served by his subordinates, foremen or department heads. Foremen very often are foremen primarily because of their expert knowledge of some technical process (this, again, growing out of the old-style way of having such knowledge in people's heads instead of upon paper) and have little ability in handling help; and they have troubles of their own all the time from conflicting orders, from instructions misunderstood because inadequate, from all the many things that ever make the coöperating activities of men at best difficult. In a word, the crude, traditional system of command works as long as a shop is small, because of the accommodation from subtle understandings and personal adjustments, and because of the sheer driving force of one man, and he the proprietor. But as soon as "personal government" is outgrown, economic resistance, in this aspect of its manifestation alone (not to speak again of the others), comes in like an armed man. And, indeed, the sheriff is not a long way off, unless with the larger scale of doing things comes a new way of doing things. The handmade product industry has not, as a rule, with its lack of wealth-creating power physically embodied in machinery, sufficient means to pay for the installation and maintenance of such non-physical equipment as is required if things are to be run properly. And many a big concern gets along under general competitive conditions (as long as it stays in beaten paths) without being shipshape, too. It may even do very well and make money in spite of wretched shop management (if no worse than its competitors) by reason of good judgment and skill displayed in buying and selling.

And now to conclude. There is a possibility of invention, of an advance of the arts, in the art of management itself. Without going into this subject at length, it is sufficient to say with emphasis that such an invention has been made, and its adoption is spreading in the industrial world. Many a small hand-made product business can now successfully expand into a large business because, by employing this managerial invention, it can with less expense do the things necessary for successful expansion. These new managerial devices are found mostly in large industrial establishments, not because they alone need them or need them most (as the layman erroneously supposes), but partly because (as already stated) the large machine-using establishments are in a better position to afford the expense, and partly because the new, big things naturally come in big places first. And now that this movement in industry which we may call planning-room methods or military "general staff" methods[1], is well under way, it draws other improvements to itself; it uncovers further possibilities of advance, notably on the side of industrial humanitarianism as contrasted with mere industrial engineering.

But in the application of these new deliberative, quasi-scientific, planning-room or "staff" methods (unique in industry because the prevailing spirit of industry is impatient, driving, non-deliberative) the entrepreneur who uses them and must pay for them, and never if he knows it spend five dollars to save four, is confronted by a new form of resistance and the possibility of diminishing returns. It is possible for such things, of course, to be greatly overdone, and, on the other hand, it is equally possible for them to be disastrously underdone. This last happens especially when the proprietor develops a new department for the work made up of men who have grown up in the business. These amateurs catch at the skirts of scientific management and get only part of its spirit and its essential methods. Especially if the proprietor himself or some committee is somewhat niggardly and fancies that omelettes may be had without the breaking of eggs, the result is a grotesque superimposing of new things on old and inadequate foundations. The installation is, so to speak, a sort of veneer of the new art of management. New-fashioned ways of paying wages are put in without the preliminary "standardization" (more or less "job analysis," so called, is as near as they come to standardization) an ambitious scheme of "functionalized control" is attempted in a place where all the elementary principles of a general system of command are neglected; a difficult and at best hazardous system of "scheduling" is undertaken where there is no proper basis of "routing" and "recording." The result, as said above, is often grotesque and costly. In such places there is not a sufficient break with tradition. What is attempted is really in the main pre-Taylor methods dressed up in new and expensive garments.

If the proprietor takes the alternative course and employs an outside professional installer he runs into opposite difficulties. The professional will usually do a better job because he is a professional; but there are incompetents in the profession, and even the best of them may have too many irons in the fire and so be forced to imitate overmuch what has been done elsewhere—not enough adaptation is made to the peculiarities of the work in that particular concern. Some of the professionals are doctrinaire, self-opinionated men, and of the sort that will ruin any enterprise through expense. Every branch of engineering has that type of man—well trained, able, but without the instinct of economy. Indeed, the entrepreneur has no royal road to success, such as cutting down his managerial resistance by merely employing a professional expert installer. Here, as elsewhere, he must not only choose the expert, but also give him his fundamental instructions. Having chosen him, he must decide how far he will let him go. If he hampers him too much, of course, the professional cannot accomplish anything, and presently throws up the case. That is, the genuine professional will. There are those, the pest of the new trade, who will do anything the client wants; just as there are some physicians of training and ability who are morally of such a caliber that they will prescribe what the patient wants. On the other hand, if the owner of the business does not hold down the management expert, frequently he will put in a top-heavy "system"; he will let his professional zeal run away with him. In general, mere "system building," done imitatively, is the evil to be avoided. Here, as everywhere else, the entrepreneur still has his own peculiar function which can never be delegated. Here, as elsewhere, he must size up the whole situation as to men and measures, things desirable and things possible, things that should be done now and things that must wait. He must recognize the limitations of the improvement of the art of management within his establishment. He must support the expert to put things through against much opposition, and he must find the way of overcoming that opposition without disheartening valued men long in his employ; or, if need be, he must decide what subordinates, unable to adapt themselves to a new order of things, he must let go. Here, as elsewhere, he has to make all the ultimate decisions as to what will pay and what will not pay. He has to determine aright—he himself and no one else—under penalty of diminishing returns and failure if he does not so determine, what to do and where to stop.

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[1] In every well-managed army the members of the general staff return for a term of service each five years or so to their regiments. The principle implied here should be kept in mind in the shop. A department in any factory charged with improvement of methods will always fail if it merely sets standards for other people. A true planning room sews up directly with the work itself throughout the plant; it has duties as well as responsibilities directly connected with production. It grows, changes its views, and is duly sympathetic. for it, too, is a "toad that knows where every tooth point of the harrow goes."

ON THE COMPUTATION OF THE PERCENTAGE OF LABOR TURNOVER

I. HOW TO FIGURE LABOR TURNOVER[1]

By Frederick S. Crum[2]

THE term *labor turnover* has been variously defined and as its calculation is dependent upon its definition, attention should first be given to just what the term means. So far as I am able to find out from reading an already somewhat extensive literature on the subject, labor turnover was first used and is still most widely used to express the phenomenon of hirings necessary to replace separations in any given industry, establishment or department of an establishment. Before the subject was analyzed too closely, perhaps, by writers of the academic type, labor turnover or the overflow of labor in any given industry or establishment, was measured in terms of the average or normal payroll, and it was expressed in the form of percentage of such payroll during the period under observation—usually a week, a month or a year. If the average payroll of a given establishment were 1,000 in a business which required that such payroll be kept at that figure and during a year 500 additions to the payroll were necessary to replace separations therefrom, the yearly labor turnover would be expressed as 50 per cent., or $\frac{500}{1000}$. On an increasing payroll in a growing business the separations from the payroll would still represent the numerator and the average payroll the denominator. On a decreasing payroll in an establishment gradually going out of business, perhaps, or declining from any cause whatsoever, the numerator would be the number hired and the denominator the average payroll, as before. In other words, average payroll by this most generally employed method is always the denominator and the number of employees *replaced* during the period under observation is the numerator in the calculation of *labor turnover*. As this is the older, so I believe it is also the best method of measuring labor turnover. Whatever method of calculation is ultimately agreed upon, the statistical problem of *labor turnover* can still be truly stated as Richard B. Gregg has stated it, namely, as the "measurement of the movement of industrial workers in and out of their employment, and the analysis of its causes and results."

At the National Conference of Employment Managers held in Rochester, N. Y., May 9-11, 1918, a committee was appointed to draft a report which would define labor turnover and state how it should be calculated. The report made by this committee reads as follows:

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[1] Reprinted by permission from *Quarterly Publications of the American Statistical Association*. New Series No. 126 (Vol. XVI), June, 1919, pp. 361-373.

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"Labor turnover for any period consists of the number of separations from service during that period. Separations include all quits, discharges and layoffs for any reason whatsoever.

"The percentage of labor turnover for any period considered is the ratio of the total number of separations during the period to the average number of employees on the force report during that period. The force report gives the number of men actually working each day as shown by attendance records.

"To compute the percentage of labor turnover for any period, find the total separations for the period considered and divide by the average of the number actually working each day throughout the period."

In brief, this committee advocated the use of attendance force rather than payroll in the calculation of turnover percentages. This seems to have been the main principle advocated in this report, but it is somewhat ambiguous and misleading in some of the statements. For illustration, labor turnover for any period does not necessarily "consist of the number of separations from service during that period." In the current and recent history of shipyard plant construction we find many illustrations of the falsity of this statement. When a shipyard nears completion many of the men engaged for its construction must be laid off from day to day, and these separations do not all represent labor turnover, according to the best and most usual definitions of that term. On a decreasing payroll only the number hired can truly represent replacements or turnover.

The statement that "to compute the percentage of labor turnover for any period, find the total separations for the period considered and divide by the average of the number actually working each day throughout the period" is to me ambiguous. Probably all that is meant is that the average daily attendance is recommended as the divisor. If so, it does not mean that only those are to be included in the denominator of the fraction who have worked or been in attendance "each day throughout the period." It is conceivable that the turnover in a given year would be represented by infinity in an establishment where no employee could show a record of 100 per cent. attendance. The point in this committee report, however, which challenges discussion is the recommendation that the working force, as shown by attendance records, be made the basis upon which labor turnover is calculated rather than payroll force.

Anyone who has had wide experience in studying comparative labor turnover figures in such an extensive industry as shipbuilding will at once question the validity of this new method apparently advocated by at least some of the employment managers at the National Conference in Rochester, last May (1918). One of the principal objections to it is that attendance is a more fluctuating factor than payroll. On an extremely hot day, 1,000 or more men out of a force of 5,000 might lay off for the one reason "too hot to work." This is not an isolated instance; there are plenty such illustrations in the daily attendance reports of the 160 or more shipyards which it was my privilege to review for a period of eleven months this past year. Heat, cold, blizzard, rain and snow are meteorological conditions which cause wide fluctuations in daily attendance in shipyard and other outdoor employments. Again, an epidemic period such as that we have been experiencing in the shipyards since September, causes most violent fluctuations, daily, weekly and monthly, in the attendance records—much wider variations, quite naturally, than are reflected in the payrolls. In the first week of October, 1918, it was reported that approximately 6,000 out of 19,000 employees of three large shipbuilding plants at Gloucester, N. J., were ill with influenza. Obviously, the resulting temporary low attendance had little or no real relation to labor turnover. Why, then, should this attendance factor be used in calculating turnover percentage?

Another objection to the attendance records as a basis for the calculation of labor turnover percentages is that very frequently the separations or quits when recorded are of employees who may not have been in attendance for a day, two days or longer. Theoretically, the payroll is, therefore, a better denominator for the labor-turnover fraction as it always contains the whole labor force, while the attendance force at any given time may range from 100 per cent. of the payroll down to 50 per cent. or even less in severe weather, during an epidemic, obstructed traffic, etc. These latter phenomena, while affecting attendance seriously, may not and often do not affect the payroll or the separations so far as these enter into the labor-force records.

One of the best statements that I have seen advocating payroll in preference to attendance as representing average force for labor turnover calculations is that by Mr. E. Goldberger, efficiency engineer, Packard Motor Car Company, published in the November, 1918, issue of *Industrial Management*. The statement follows:

"The total number of men that have been hired and been paid off, *i. e.*, actually replaced, represents a complete turnover, and if there be an excess of men hired over paid off, they actually are to be accounted to increase in force, while if there be an excess of men paid off, they represent a decrease in force.

"There are more reasons in favor of counting the men on our books rather than those really attending, as some men leave without notice, passing through a transitory stage of not attending and still being on the books, so that, when they leave and are counted in the turnover, they do not represent the turnover of the force working, but of that on our books.

"It is much easier to count the men on the books than those attending, as the first information can be made available quickly in the employment office, while the last one has to be made available by many clerks in different departments or by the time office.

"It is very likely that high wages, where they are unwarranted, will force us to face the problem of absentees, and to study a standard coefficient of attendance. This is, in my opinion, a good enough reason to keep the same denominator for all three coefficients—labor turnover, labor fluctuation and labor attendance."

The following quotation[1] also is in conformity with my own point of view, as regards the method of calculating the labor turnover:

> What most persons mean by labor turnover is labor replacement. The term labor turnover arose in connection with discussions of the cost of hiring and firing workers. It was recognized that men drifted in and drifted out of industries. Competent men often did not stay, and incompetent men had to be fired after expensive trial. Effective labor service finds the right man for the right job and then gets him to stick. If he does not stick then someone else has to be hired to take his place, or if a mistake in judgment is made and an unfit person employed, then that person has to be fired and another worker found for his job. This is labor turnover but a better and more accurate phrase is to think of it as necessary *labor replacement.*
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> The National Employment Managers' conference by deciding that the number of employees actually working each day rather than the number appearing upon the payroll should be the proper base for computing labor turnover introduced another factor into personnel fluctuation. This factor, which may be termed *labor variation*, is something different from either plant change or labor replacement.
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> The number of the working force actually working on any one day is dependent upon sickness and accident, upon explainable absences, and upon habitual loafing usually after pay day. Increasingly, employment offices are keeping records of these daily absences, seeking for the causes of these constant leaks and endeavoring to stop them. But such absences do not mean usually that a man is fired or even that some one is hired to take his place. This labor variation is not labor turnover as the term is ordinarily used. Yet if the daily working force rather than the payroll sheets are used as the base for figuring labor turnover then this element of temporary absences affects to some degree the percentages.
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> A report then of personnel fluctuation for any period of time should show in percentages the plant change, the labor replacement and the labor variation. These are three distinct elements in the personnel fluctuation. They are due to different causes, require different remedies and should never be confused.
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> One other subdivision may be desirable. Persons whose places must be refilled leave for avoidable and unavoidable reasons. Among the unavoidable reasons are marriage, death, ill health, retirement, family leaving city, and military service. It is worth while to divide the leavings under labor replacement into avoidable and unavoidable, making separate percentages. The decrease of the avoidable leavings from week to week, and from year to year, is the true measure of the efficiency of the labor service.
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> While a record should be kept of all transfers from one department to another within the plant, these transfers should not enter into the calculation of any personnel fluctuation as they do not increase or decrease the working force.
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> The simplest way of calculating these three elements of personnel fluctuations is by the week, and the simplest base to use is the number on the payroll.

Daily attendance records are extremely important and hours-of-work records, also very important for several purposes, should be available to the manager of a plant or establishment, but I seriously doubt their utility in the calculation of labor turnover. Payroll measured against daily attendance gives a reasonable notion of the percentage and total amount of absenteeism. Such ratios could be computed weekly, monthly, quarterly and yearly. In other words, daily attendance should preferably be considered as a coefficient of payroll. Among shipbuilders, for the country as a whole, approximately 85 per cent. of the average payroll was in daily attendance. There were wide variations, however, from this figure when individual yards, different sections of the country and the different seasons of the year were considered.

For a proper measurement of daily attendance good payroll records must be freshly available and, if available, there would appear to be no good reason why labor turnover should not be measured against payroll rather than against attendance—a more widely fluctuating, and at least as regards *labor flow* a more artificial factor than payroll. Perhaps one objection to the use of payroll records is that they sometimes are not cleared frequently enough. This is not a valid objection in labor turnover calculations, for the net gain or loss in the payroll is readily obtained when the number hired and the number of separations are known for a given period. An effort should be made to bring about standard and uniform practice in the keeping of all labor or work-time records, and payroll records unquestionably should be more uniform and accurate than at present. Probably the most generally feasible plan would be to have the payrolls cleared at least twice a month, preferably, perhaps, on the first and fifteenth of each month. Such payroll figures would, I believe, give an excellent basis from which to calculate labor turnover or replacement percentages, labor fluctuations, and daily attendance. If the payroll were cleared weekly the accuracy of the calculations would, of course, be somewhat greater.

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[1] From "Standardizing Labor Turnover" by Harry W. Kimball, *Industrial Management*, December, 1918.

Unless some sound standard as to the factors which shall be used in calculating labor turnover is adopted and applied generally at an early date, there will be created a still greater statistical chaos than already exists. At present not only is there no universally or even generally recognized method of calculating labor turnover, but there is also an "utter lack of any standards in estimating cause, extent and cost of labor turnover."[1]

An efficient employment manager is probably the first and most important step in any effort to bring about stability in the labor force of an industrial plant. The employment manager can perhaps best demonstrate his efficiency by pointing to the reduction of the labor turnover under scientific as compared with the previous and presumably unscientific "hire and fire" method of foremen. To the employment manager, therefore, it is important that his methods of calculating labor turnover shall be uniform and on a basis that can be defended by sound common sense and logic.

Labor turnover should be measured for the principal departments of any given plant as well as for the plant as a whole. Transfers from one department to another would enter into the labor turnover of the departments affected, but such transfers would not count in the labor turnover of the whole plant. In the United States there is a large amount of interstate migration but these migrants are not added to the statistics of immigrants and emigrants for the United States. The analogy illustrates how transfers should be handled. The labor turnover of the departments of any given plant if summed would show too large a labor turnover for the plant as a whole, provided there had been interdepartmental transfers.

Turnover figures are valuable only as they are used and understood by the employment manager and by the plant management as an index to the labor conditions. When the labor turnover figures are reduced to simple percentages which always have definite significance, the management will get light upon many problems, the solution of which is necessary to effect a reduction in turnover. As the necessary remedies are applied the labor turnover percentage furnishes an index of the result of the remedies. A few of the many partial solutions of the big problem of turnover are profit-sharing, bonus payments, group insurance, other insurance provision for employees such as disability allowances, pensions, etc., good restaurant facilities, quick promotions for the most capable, careful fitting of the employee to the job, etc.

Mere expression of labor turnover in percentages will never solve the problem, but a simple mathematical statement of its size is likely to persuade the manager that it is important to seek for the causes why men leave in such large numbers. Next, he is apt to study the cost of turnover and, finally, he will be in a position to justify to himself or to the owner of the business that it is better to spend money for preventative measures than for the wasteful and reckless hiring and firing methods so usual in American business. The mathematical formula of labor turnover will thus be transformed into a better understanding of the human element, with the result that the average length of service of the employees will be considerably extended and the labor turnover correspondingly reduced, to the great and mutual advantage of employer and employees.

ILLUSTRATIONS OF LABOR TURNOVER CALCULATIONS.

For an increasing payroll the following example will illustrate the method when payrolls and changes in same are available in weekly reports. Some months

INCREASING PAYROLL

Week Ending	Payroll	No. Hired	No. Lost	No. Replaced	Labor Turnover Percentage	
					Weekly	Yearly
Oct. 5, 1918	2,593	37	15	15	.58	30.1
Oct. 12, 1918	2,615	42	17	17	.65	33.8
Oct. 19, 1918	2,640	26	19	19	.72	37.4
Oct. 26, 1918	2,647	17	20	17	.64	33.4
Nov. 2, 1918	2,644	22	18	18	.68	35.4
Total.....	13,139	142	89	89	3.39	35.2
Av. Payroll	2,628					

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[1] *An Initial Survey of the Problem of Labor Turnover,* Confidential Series, Report No. 1, the National Association of Corporation Schools.

will embrace five weeks and others four. Any given week should be included in that month which embraces four or more of its days. When five weeks are included in a given month the turnover percentage for the month must be multiplied by 10.4 to reduce it to a yearly basis, and when only four weeks are included the factor for multiplication is 13.

In this example the fundamental data are assumed to be available, week by week, and the establishment is assumed to be a growing one with weekly additions to the force generally larger than the subtractions from all causes whatever. In this example the weekly percentages of turnover varied only slightly, or from .58 to .72. Multiplying the weekly turnover percentages by 52 reduces them to a yearly basis. For the month ending November 2, the turnover percentage was 3.39. As the period was really five weeks, or 10.4 part of a year, the turnover percentage reduced to a yearly basis is 3.39 multiplied by 10.4, or 35.2.

In the next example the week ending October 26 is purposely shown as indicating a greater loss than gain in the payroll. The replacements for that week represent the number hired rather than the number lost, or 17 rather than 20. For the five weeks as a whole, however, the number hired is in excess of the separations so in the totals the 20 is included as replacements. When large numbers of industrial establishments are being followed week by week, as is done in the Emergency Fleet Corporation, the weekly turnover percentage is a valuable index of the general trend of this phase of the labor problem. It should also serve a useful purpose in any industrial establishment. The payroll, however, should be cleared weekly, if feasible, and at worst not less often than every two weeks if the labor turnover is to be calculated with a close approximation to exactness.

DECREASING PAYROLL

Week Ending	Payroll	No. Hired	No. Lost	No. Replaced	Labor Turnover Percentage	
					Weekly	Yearly
Oct. 5, 1918	6,754	70	95	70	1.04	53.9
Oct. 12, 1918	6,729	47	83	47	.70	36.3
Oct. 19, 1918	6,693	27	78	27	.40	21.0
Oct. 26, 1918	6,642	50	45	45	.68	35.2
Nov. 2, 1918	6,647	39	60	39	.59	30.5
Total......	33,465	233	361	233	3.48	36.2
Av. Payroll	6,693					

In this example the payroll is fairly continuously diminishing. In such instances the number hired rather than the number of separations represents the turnover for only such losses are replaced as are represented by number hired during the period under observation. During the five-weeks period, in the example, obviously the turnover percentage is represented by 233, the number hired, divided by 6,693 the average payroll, or 3.48. The factor 3.48 multiplied by $\frac{52}{5}$ or 10.4, gives 36.2 as the labor turnover percentage, yearly basis.

During the week ending October 26, 50 men were hired as against 45 lost from the payroll. In the calculation of the weekly turnover percentage for that week, the number of replacements must be considered as 45, therefore, and not 50, although the 50 should be used when calculating the turnover for the five-weeks period.

If labor turnover percentages are to be calculated only on a monthly basis, the payroll should preferably be given for the first and fifteenth of the month so as to get as true an average or mean payroll as possible. If this is not feasible the next best thing is the payroll at the beginning and end of each month from which approximate means can be derived for each month by taking the sum of the two numbers and dividing by two.

The simplest formula for labor turnover and one which will serve every practical purpose is as follows:

$$T = \frac{R}{\dfrac{P_1 + P_2 + P_3 + - P_n}{N}}$$

In this formula:

T = Turnover

R = Replacements, or number hired to replace losses.

P = Payroll.

N = Number of Payrolls used in striking an average for the period under observation.

A PARTIAL BIBLIOGRAPHY OF RECENT ARTICLES ON LABOR TURNOVER.

The Problem of Labor Turnover—By Paul H. Douglas. The American Economic Review, pp. 306-316, June, 1918.

Standardizing Labor Turnover—By Harry W. Kimball. Employment and Labor Maintenance, p. 506, December, 1918.

Labor Turnover and Safety—By H. W. Forster. Proceedings of the National Safety Council. Sixth Annual Safety Congress, Part I, pp. 153-155, September, 1917. Also in same report, pp. 200-202, Report of Committee on Standard Forms relating to the Conservation of the Health of Workers. By J. W. Schereschewsky, Chairman, Surgeon, U. S. Public Health Service.

Labor Turnover in Cleveland and Detroit—By Boris Emmet. Monthly Labor Review, pp. 11-30, January, 1919. U. S. Bureau of Labor Statistics, Washington, D. C.

Labor Turnover—By George J. Eberle. The American Economic Review, pp. 79-82, March, 1919.

Methods of Reducing the Labor Turnover—By Boyd Fisher. Proceedings of Employment Managers' Conference, Minneapolis, January 19 and 20, 1916. Published in Bulletin of the U. S. Bureau of Labor Statistics, whole No. 196, May, 1916.

The New Apprenticeship as a Factor in Reducing Labor Turnover—By Charles A. Prosser. Proceedings of Employment Managers' Conference, Minneapolis, January 19 and 20, 1916. Published in Bulletin of the U. S. Bureau of Labor Statistics, whole No. 196, May, 1916.

Employment Managers Solving a Business Problem—By Dr. Ernest Fox Nichols. The Nation's Business, pp. 14, 15 and 17, March, 1916.

Methods of Reducing the Labor Turnover—By Henry S. Dennison, of the Dennison Manufacturing Co. Bulletin of the United States Bureau of Labor Statistics, whole No. 202, pp. 56, 57, 58, 59, September, 1916.

The Cost of Labor Turnover—By Magnus W. Alexander, of the General Electric Co., West Lynn, Mass. Bulletin of the United States Bureau of Labor Statistics, whole No. 227, pp. 13-28, October, 1917. Also, same Bulletin, *How to Reduce Labor Turnover.* By Boyd Fisher, Vice President, Detroit Executives' Club, pp. 29-47. Also, same Bulletin, *The Tabulating of Labor Turnover.* By E. H. Fish, Employment Manager, Norton Co., Worcester, Mass; Chairman Committee on Labor Turnover of the Employment Managers' Association of Boston, pp. 50-55. Also, same Bulletin, *Determining Cost of Turnover of Labor.* By Boyd Fisher, Vice-President, Detroit Executives' Club, pp. 60-66. Also, same Bulletin, *An Actual Account of What we have Done to Reduce our Labor Turnover.* By J. M. Williams, Secretary, Fayette R. Plumb (inc.); President, Philadelphia Association for the Discussion of Employment Problems, pp. 173-190.

Handbook on Employment Management in the Shipyard. Special Bulletin, *Labor Loss,* Employment Management Branch, Industrial Relations Division, United States Shipping Board Emergency Fleet Corporation, Philadelphia, 1918.

Hiring and Firing—By Lee K. Frankel, Ph. D., Supervisor, Welfare Division, with the coöperation of Laura S. Seymour. *Suggestions for Employers,* Industrial Service Bureau Bulletin No. 1. Metropolitan Life Insurance Company, New York, 1918.

Absenteeism—Reports from plants in different localities. United States Department of Labor, Information and Education Service, Washington, 1918.

Reducing Labor Turnover in our Shops—By Fred H. Colvin. American Machinist, pp. 27, 28, 29, January 3, 1918.

The Employment Manager and the Reduction of Labor Turnover—By Thomas T. Read, E. M., Ph. D., New York, N. Y., Technical Department, New Jersey Zinc Co., Bulletin No. 130 (October, 1917), 1833. Transactions of the American Institute of Mining Engineers (subject to Revision), (New York Meeting, February, 1918).

Standardization of the Causes of Leaving Jobs—By J. D. Hackett. Industrial Management, pp. 233-234, March, 1918.

Labor Factors in Our Shipping Program—How to Procure and Maintain Shipyard Workers and Hasten the Building of our Emergency Fleet. By Roy Willmarth Kelly, Industrial Management, pp. 210, 217, March, 1918.

Methods of Arriving at Labor Turnover—By J. M. VanHarlingen and T. J. Dwyer. Employment and Labor Maintenance, pp. 319, 320, April, 1918.

How to Reduce the Turnover of Labor—Methods successfully applied at an Ohio Steel Works—Get the Right Man for the Job and Advance the Fit Men. By Ernest C. Gould. The Iron Age, pp. 874-5, April 4, 1918.

The Problem of Labor Turnover—By M. C. Hobart. American Machinist, Vol. 48, No. 20, pp. 821-822, May 16, 1918.

Confidential Report Series, Report No. 1—*An Initial Survey of the Problem of Labor Turnover.* Issued by the National Association of Corporation Schools, compiled in the Office of the Executive Secretary with the Coöperation of the Committee on Employment and Dr. Paul Kreuzpointer, Investigator. Available to Class "A" Members only, May, 1918.

Keeping Track of Labor Turnover—By E. H. Fish. In Plants where Semi-Skilled Men Must Be Trained to Meet Labor Needs, a Careful Compilation and Analysis of Turnover Records is Worth Many Times the Expense Involved. Employment and Labor Maintenance, pp. 445, 446, September 12, 1918.

Computing Labor Turnover—A Questionnaire. Industrial Management. pp. 239-246, September, 1918.

Diagnosing Labor Ills—By William Lamkie. Employment and Labor Maintenance, p. 502, June, 1918.

Why Men Leave Their Jobs—By Henry P. Dutton. Employment and Labor Maintenance, pp. 147, 148, August, 1918.

Absentee Record Forms—U. S. Department of Labor, Working Conditions Service, Grant Hamilton, Director General, Division of Labor Administration. Circular No. 4, March 17, 1919.

Proper Systems Reduce Labor Turnover—Wide variation in Turnover Percentages Due to Factory Methods—Many Plants have over 500 Per Cent. Yearly. Automotive Industries, pp. 619-20-21 and 667, March 20, 1919.

Labor Turnover and Industrial Training—Training Bulletin No. 6, U. S. Department of Labor, United States Training Service, Washington, D. C., 1919.

Labor Turnover in Cincinnati—By Emil Frankel. Monthly Labor Review, March, 1919, U. S. Department of Labor, Bureau of Labor Statistics, Washington, D. C.

Some Reasons for Labor Turnover—By Harry W. Kimball. Industrial Management, pp. 324-6, April, 1919.

(Continued on next page.)

THE workman "is not a mere machine to be kept well oiled with good wages, well tended by not being worked for too long hours, and kept in good going repair by welfare systems, canteens, and good house conditions. He is a complex human being, with all the ambitions, ideals, and mental outlook possessed by the capitalists in an equal and sometimes superior degree." (Lord Leverhulme, *The Six-Hour Day,* p. 118).

"WE are agreed that the elements in production and distribution are Capital and Labour—I prefer myself to make it a three-legged stool by including Management as apart from Capital and Labour. But sometimes Management is part of the activities of Capital, and at other times must be included with Labour." (Lord Leverhulme, *The Six-Hour Day,* p. 118).

II. METHODS OF COMPUTING LABOR TURNOVER[1]

BY PAUL H. DOUGLAS[2]

THE recent discovery of the extent and costs of labor turnover has brought with it varying methods of computation. In order that a standard practice might be adopted, the National Association of Employment Managers at their annual meeting in May, 1918, adopted the following method[3] which has since been approved by the United States Bureau of Labor Statistics as the basis for its investigations[4]. "To compute the percentage of labor turnover for any period, find the total separations for the period considered and divide by the average of the number actually working each day through the period."

Before criticising this method it is necessary to determine just what is meant by "turnover." Labor turnover is simply the number of men hired by a given business unit to take the places of men who have left. Turnover in this sense is exactly similar to the use of the term by any retail merchant to indicate the disposal of certain units and their replacement by other units.[5] Turnover as such does not begin until replacement occurs.

The percentage of labor turnover is the proportion which these newly hired men who actually replace others form of the average force employed in a given period of time. It indicates the percentage of men which it has been necessary to hire in order to maintain a constant labor force. In itself it indicates nothing as to whether the force itself is being increased or decreased.

In the light of this definition (which I believe would be approved by every student of the problem), the method of computation adopted by the Bureau of Labor Statistics is defective in the following ways:

1. It uses separations rather than replacements as the basis of turnover. The definition of turnover adopted by the Employment Managers Association is indeed as follows:

> "Labor turnover for any period consists of the number of separations from service during that period. Separations include all quits, discharges, and lay-offs for any reason whatsoever."

It is true that in a period in which the working force of the given plant is being increased, separations do roughly constitute the amount of turnover which takes place. Men are being hired not only to increase the net working force, but to take the place of those who have left. It is only in the latter sense that they constitute replacements and enter into turnover. Separations in this case, therefore, do approximately measure replacements. To be absolutely accurate, however, one should subtract the vacated positions which have not been filled from the total separations to secure the number of actual replacements. Such a deduction, however, although ideally necessary may not be practically possible in many instances due to insufficient payroll data.

But the case is different if the labor force is decreasing. Suppose that a given plant decreases its force in a given period of time from 1,000 to 900 and hires no new men. There are 100 separations but no new men have entered the plant. Turnover as such has not occurred. Yet the method adopted by the Bureau of Labor Statistics would show a labor turnover of 100 men. Plainly, therefore, in this case separations do not measure replacements. The number of men newly hired do constitute replacements. It is not correct, moreover, in the case of a declining labor force to deduct the positions vacated but not replaced from the number newly hired since those newly hired have replaced some workers even if they have not replaced the particular ones whose positions are vacated.

The proper method, therefore, of determining replacements should take:

a. The number of separations actually replaced as the base in the case of an increasing force.

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[1] Reprinted by permission from *The American Economic Review,* Vol. IX, No. 2, June, 1919, pp. 402-405.

[2] Emergency Fleet Corporation, Philadelphia, Pa.

[3] For a full statement of this report see *Monthly Review,* United States Bureau of Labor Statistics, June, 1918, pp. 172-173. That this method did not introduce uniformity may be seen from the symposium on labor turnover in *Industrial Management,* September, 1918, pp. 239-246 and November, pp. 425-26, in which from five to six different methods were advanced, practically all of which, in the opinion of the author, are wrong.

[4] See "Labor turnover in Cleveland and Detroit," by Boris Emmett, *Monthly Review,* Jan., 1919, pp. 11-30; "Labor turnover in the San Francisco Bay region," by Paul F. Brissenden, *Monthly Review,* Feb., 1919, pp. 45-62.

[5] With the exception, of course, that a high labor turnover means an economic loss to the employer, while a high turnover of goods means an economic gain to the merchant.

b. The number newly hired as the base in the case of a decreasing force.

2. It uses the average attendance as the denominator instead of the number actually employed by the company. The best index of the average number actually employed is not the average attendance but the average number on the payroll.[1] The use of the average attendance as the denominator confuses absenteeism with turnover. Recent investigations show that from 6 to 15 per cent of the working force are absent daily. Yet these men fill positions which are part of the working force and consequently should not be disregarded in computing the average working force. Absenteeism should be treated as a separate item in labor loss and not included in the computation of turnover.[2]

The preceding paragraphs indicate the methods which I believe should be followed: To compute the percentage of labor turnover for any period, find the total replacements for the period considered and divide by the average number on the payroll.

The difference between the method proposed by the author and that adopted by the Bureau of Labor Statistics may be seen from the following two non-algebraic examples:

Example A

COMPUTATION OF LABOR TURNOVER WITH AN INCREASING LABOR FORCE.

1. Given statistics:
   Number employed at beginning of month 1,000.
   Number employed at end of month 1,100.
   Number newly hired 300.
   Number positions vacated not filled 10.
   Average daily attendance 900.
2. Method of Bureau of Labor Statistics:
   Number of separations=300-(1100-1000)=200.

$$\text{Labor turnover} = \frac{200}{900} = 22.2 \text{ per cent.}$$

3. Method proposed:

$$\text{Average force on payroll} = \frac{1000 + 1100}{2} = 1050.$$[3]

Number of replacements=300-(1100-1000)-10=190.

$$\text{Labor turnover} = \frac{190}{1050} \text{ or } 18.1 \text{ per cent.}$$

$$\text{Percentage of absenteeism} = \frac{150}{1050} = 14.3 \text{ per cent.}$$

Example B

COMPUTATION OF LABOR TURNOVER WITH A DECREASING LABOR FORCE

1. Given statistics:
   Number on payroll at beginning of month 1,000.
   Number on payroll at end of month 900.
   Number newly hired 25.
   Average daily attendance 800.
2. Method of Bureau Labor Statistics:
   Number of separations = 25 + (1000-900) = 125.

$$\text{Labor turnover} = \frac{125}{800} \text{ or } 15.6 \text{ per cent.}$$

3. Method proposed:

$$\text{Average number on payroll} = \frac{1000 + 900}{2} = 950.$$

Number of replacements = 25.

$$\text{Labor turnover} = \frac{25}{950} \text{ or } 2.6 \text{ per cent.}$$

$$\text{Percentage of absenteeism} = \frac{950\text{-}800}{950} \text{ or } 15.8 \text{ per cent.}$$

It will be noticed that the use of this method results in a much lower turnover rate which is especially true in the case of a decreasing labor force.

The labor turnover for a given period should be reduced to a yearly basis in the same fashion that the Public Health Service reduces mortality and morbility statistics to a yearly rate. If the given period is a month, the percentage should be multiplied by 12; if a week by 52. Care should be taken: (a) that the replacements listed should not include former employees newly hired for their old positions; (b) that the statistics be compiled for departments and trades as well as for the plant as a whole.

"THE capitalist has a deep-rooted belief in the *fallacy* that the lower the wages and the longer the hours worked by Labour are, the lower the cost of production must be . . . Labour has a deep-rooted belief in the *fallacy* that there is only a certain limited amount of work to be divided amongst an ever-increasing number of workmen, and that, consequently, restriction of output is the most sure and certain way to provide work for all; . . . " (Lord Leverhulme, *The Six-Hour Day*, p. 117—italics ours).

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[1] Care should be taken that the payroll does not contain "dead wood", or men who have really left the employ of the company.

[2] Mr. Boris Emmett, an investigator for the United States Bureau of Labor Statistics, in his article on the "Nature and computation of labor turnover," *Journal of Political Economy*, Feb., 1919, pp. 105-117, has come to believe in the use of hirings rather than separations in a decreasing work force, but he still clings to the use of the average attendance as the denominator. One of his objections to the use of the payroll is that it contains absentees. Of course it does, but these can be computed separately and should not be confused with turnover.

[3] That is, the arithmetic average of the number employed at the beginning and end of the month. The number each week can be averaged if more accurate methods are desired.

PRINCIPLES OF STORAGE[1]

By Henry Wood Shelton[2]

PART I. THE LAYOUT OF STORAGE SPACES

The aim of Part I is to aid in the more economical and effective use of storage space, and to insure the possibility of finding without delay any item known to be on hand.

Good marking of storage spaces, making it possible to tell instantly where a given item of stores is, depends on good layout. The ability to go direct rather than in a round-about way to any item in a good layout depends on good marking. In planning for either marking or layout, their interdependence should be kept in mind.

Some of the storage areas abroad are seven or eight miles long and several miles wide. The ease and speed with which any item in such an area can be found is the test of its marking and layout. Any marking and layout scheme, therefore, must be able on the one hand to locate any building, section, or other storage space in an area of 20 or 30 or more square miles, and on the other to indicate in what bin and floor of a particular storage warehouse a certain grade and make of pencil may be found. The scheme must be accurate, logical, flexible to fit different conditions, and indefinitely expansible.

Such expansibility, however, involves the use of larger and larger divisions of space,—each one well defined and bearing a definite relation to each other one. Such standardized gradation has long been established in the army in dealing with different sized groups of men. It has never been done in dealing with different sized divisions of storage space. To meet this new need the terms defined are offered as a step toward a generally accepted classification of storage spaces. They comprise seven steps from a "unit" (of perhaps one square yard) to a "tract" (of perhaps 40 square miles). The possibility of designating any square yard ("unit") of storage space in an area of possibly 800 square miles (20 "tracts") by seven letters of the alphabet, indicates the practical simplicity of the scheme outlined in the instructions. The utility of any such scheme, however, depends on the consistent application of the fundamentals outlined and discussed.

I. DEFINITIONS

Introductory

In thinking of a layout, think of a checkerboard. The size of the layout would determine what divisions (as defined below) the checkerboard would represent.

If the checkerboard represented a "section" the individual squares would represent "units," arranged in "rows" (without showing, however, the aisles necessary to give direct accessibility to each unit).

Turn the checkerboard, or half of it, upon edge—and you have the front view of a row of bins arranged in "tiers," each column being directly above a unit area.

In case of a larger layout, the checkerboard might represent a "field" (instead of a "section"). Then the individual squares would represent "sections" arranged in "series."

In case of a still larger layout, the checkerboard might represent a "tract" (instead of a "field"). Then the individual squares would represent "fields" arranged in "ranges."

1.—*Layout:* The arrangement of total available stores area into various spaces reserved for receiving, moving and storing and where necessary for assembling and shipping.

2.—*Unit:* The area adopted as a standard unit for building up the storage layout. It should be rectangular and will generally be the smallest storage space given particular identification. (see Figure 1).

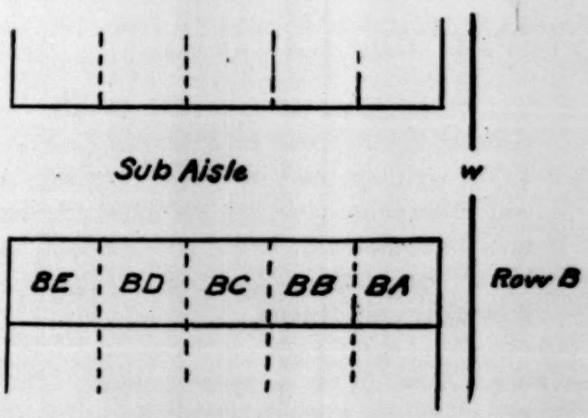

Figure 1.

A row (B) of units (BA, BB, BC, etc.)

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[1] Reprinted by permission from bulletins issued by the Storage Committee, War Industries Board, for the use of supply officers of the Army and of the Navy.

[2] Assistant Professor of Business Organization and Management at the Amos Tuck School of Administration and Finance, Dartmouth College, Hanover, N. H.

3.—*Tier:* A horizontal section of a column, generally of bins, piled directly above unit areas. Each bin would be located in a certain tier and would be identified in addition to the unit over which it was placed. (see Figure 2).

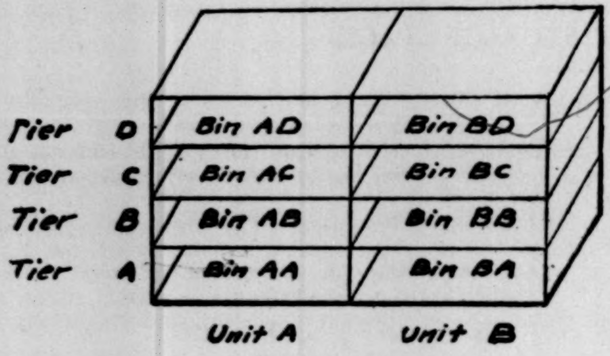


FIGURE 2

Two columns of bins four tiers high.

4.—*Row*: A straight line of units. A row is generally limited on the ends by the limits of the section, and on the sides by an aisle or an adjoining row or the border of the section. Rows may be cut at right angles by aisles. (see Figure 3).

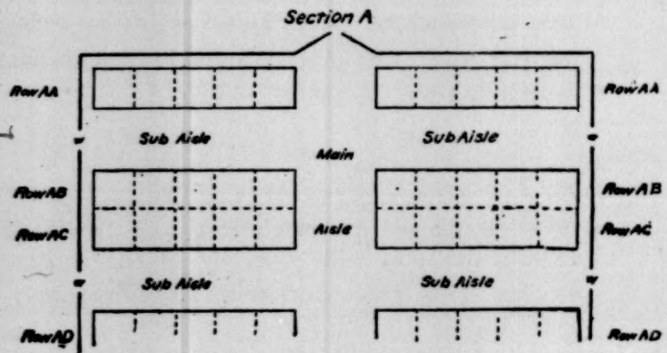
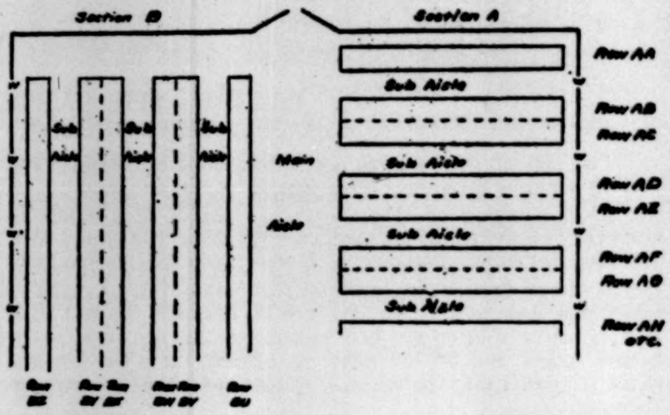


FIGURE 3

Rows (AA, AB, etc.) at the end of a section (A) and cut by a main aisle. Dotted lines mark units.

5.—*Sections:* A group of generally parallel rows. Generally, difference in direction (see Figure 4), or in uniformity of rows (see Figure 5) will determine different sections. A section may be bounded by walls, aisles or only imaginary lines, but its separate identity will be kept clear and distinct.

6.—*Series:* A line of two or more sections. The separate identity of each series like that of each section will be kept clear, preferably by some natural boundary such as a wide main aisle in a building, or a roadway out of doors. It may be compared to a line of squares on a checker board, if each square represented a "section."

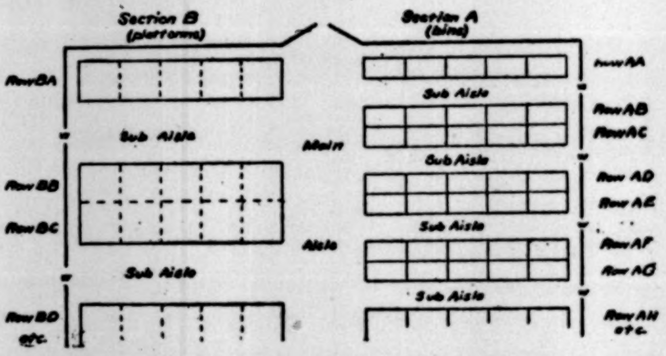


Lengthwise rows (Incorrect)

Crosswise rows (Correct)

FIGURE 4

Separate sections in one room due to difference in direction of rows. This figure also contrasts the incorrect lengthwise arrangement with the correct crosswise arrangement of rows. (See III, B, 2).



Specimen layout for floor or platform storage for bulk or case goods.

Specimen layout for bin storage for small or broken package goods.

FIGURE 5

Separate sections in one room due to lack of uniformity of rows.

7.—*Field:* A group of generally parallel series. A field corresponds on a larger scale to a section. The separate identity of each of several fields will be kept clear whether by natural or artificial boundaries, or by conspicuous signs. A field may be compared to a whole checkerboard, composed of several "series" of "sections."

8.—*Range:* A straight line or row of fields. A range corresponds on a larger scale to a series of sections or a row of units. Its boundaries should be well defined so that its identity may be kept distinct.

9.—*Tract:* A group of generally parallel ranges. A tract corresponds on a larger scale to a field or section. Its boundaries should be clearly defined so that its identity may be kept distinct.

10.—*Location Symbol:* A combination of letters or figures indicating a particular location.

General Example.

On the basis of a *unit* of 1 square yard:
A *row* of 20 such units would comprise 20 sq. yds.
A *section* of 20 such rows would approximate 800 sq. yds. or 1-6 acre (including aisles).
A *series* of 20 such sections would approximate 3 1-3 acres.
A *field* of 20 such series would approximate 66 acres or 1-10 sq. mile.
A *range* of 20 such fields would approximate 2 sq. miles.
A *tract* of 20 such ranges would approximate 40 sq. miles. 20 such tracts would approximate 800 sq. miles.

Any particular square yard of storage space in an area of 800 square miles can then be designated by seven letters. Thus, the symbol BLANKET would indicate tract B, range L, field A, series N, section K, row E, unit T. A particular tier in a column of bins over a unit would be indicated by the addition of another letter.

II. FUNDAMENTALS

I. Marking

1.—*Consistency:* the building up of the marking system scheme so logically that the process of locating any one item will be consistent with that of locating any other.

2.—*Standard base lines or points of reference* from which to begin any series of location symbols. These should be reasonably permanent. As a corollary to this the boundary lines of all divisions of storage space should be clearly marked.

3.—*Standard directions* in which to build up any series of location symbols.

4.—*Standard unit storage area,* preferably rectangular, and capable of definite designation by a location symbol.

5.—*A location symbol for each unit area.* The symbol should be short, easily understood and remembered, and in itself a guide to the location designated.

6.—*Permanence.* Location symbolizing should be done in such a way that in case of expansion the existing symbols will be subject to the least change.

2. Layout

1.—*Standard unit storage area*—the basis for entire layout. In planning areas, fractional parts of the standard unit are to be avoided, except where bins are used. Bins are frequently smaller than the standard unit (preferably an even fraction of it), and space for them will have to be planned accordingly. Standard units afford flexibility.

2.—*Crosswise rows* rather than lengthwise are preferable in oblong sections. In an approximately square section, the rows should generally be at right angles to the direction of greatest traffic.

3.—*Parallel rows* in any given section. Rows in different directions, as at right angles to each other, or lining all four walls, are to be avoided as far as possible.

4.—*Straight lines and right turns* for aisles and rows —city block scheme. Uniformity of plan will increase economy of space.

5.—*Aisles,* width, location and arrangement, governed by necessities of use. Consideration will be given to proper width of main aisles for two-way passing and sub-aisles for one-way passing. Where possible, floor space along a wall should be planned for storage rather than for aisles.

6.—*Expansion*—direction of normal and most advantageous expansion is to be considered in planning layout.

III. DISCUSSION AND GENERAL SUGGESTIONS

The location of stores according to their classification (name or symbol) has frequently been advocated. For example, items whose name, class, or symbol begins with A are put in the first row, and those beginning with Z in the last row. It is claimed that this is much simpler because the items "locate themselves." This may be practicable in a small storehouse with little change in either variety or quantity of items carried. In large scale operations, however, it breaks down, and it is a question whether it is ever really better than the complete separation of identification and location.

The vital weakness of the plan is that the considerations determining the classification of an item for identification are entirely different from those determining its most advantageous location. Suppose E stands for electrical supplies, F for fuel of all kinds, and H for hardware; should they be stowed in that order, the coal pockets between the bins containing electric fixtures and those containing hardware? The considerations determining classification are primarily those of the nature of the material or its use or form, and are chiefly for accounting purposes. The considerations determining location are difficulty of handling, quantity to be carried, frequency of use, special considerations (as of sensitiveness, perishability, etc.) and safety, and are based on low cost of handling.

A storekeeper must be free to locate his items for most advantageous and economical handling. He may have broken package stock for immediate issue in one place, reserve stock in another, and perhaps a wholesale supply in still another. Yet, with a consistent and logical marking scheme, he can keep track of it all easily and accurately without relying on his memory.

City street numbers do not change with the names of changing tenants. Similarly, storage location symbols should not change, no matter what items are moved in or out. The identification symbol indicating *what* an item of stores is should be independent of a location symbol indicating *where* it is. The discussion of marking in this memorandum is based on the recognition of this truth and deals with a marking scheme related to the layout, but not to the goods which are to go in the layout.

1. MARKING

Consistency.

1. Haphazard marking of location is to be avoided. The instructions for a definite scheme of marking given in Section IV are designed to cover a considerable range of special conditions, assuming that proper principles of storage (see Part II) are followed.

Standard base lines or points of reference.

2. Just as the equator and meridians furnish base lines of reference without which distance and location on the earth's surface could not be determined, so in stores layout there must be standard base lines in reference to which the location of a given unit may be determined. These are the natural boundaries of the total storage space or individual sections. Out-of-doors, for instance, a base line might be a river, steep bank, highway, railroad track, stonewall, board fence, or other boundary line to remain during the use of the space for storage. Within doors, the walls of the building and the aisles that are necessary for passage form natural base lines from which to start the series of location symbols.

Showing the boundary lines of aisles and likewise of storage, receiving, assembling, and shipping places is important in order that there may be no vagueness about the limits of the spaces required for each. The more permanent and conspicuous these boundary lines are made, the better. In buildings, lines two inches wide, of black or red paint, or of strips of zinc tacked to the floor, have been used effectively. Platforms and bins should be placed so as to conform to the planned layout.

Standard directions.

3. The boundaries of any areas will usually correspond in a general way to the four points of the compass, north, east, south and west. Therefore, the subdivisions of a storage area will generally parallel two opposite bounds and would run in corresponding directions. In the rare cases where bounds run exactly, for instance northeast and southwest, some one boundary from which to determine standard direction must be arbitrarily chosen.

Standard unit storage area.

4. A section or quarter-section of land is a unit well known to settlers in new territory. It is used by the government to locate precisely every part of the country. For the same reason, a standard unit area, rectangular so that the whole layout may be systematically plotted, is important for logical marking.

The size of the standard unit area will be determined primarily with reference to the goods to be stored so that when the layout is completed the areas will be occupied by the various items with a minimum of waste space. There is naturally no objection to using a number of adjoining areas for the stowing of large items in large quantities, or, on the other hand, to using a single unit for stowing several small items in small quantity. The unit areas, however, with their symbols enable one to determine definitely the location of any item.

A location symbol for each unit area.

5. It is clear that a complete description in words of any particular location would be a long and complicated affair and that, without some system of symbols representing the complete description, systematic marking would be impossible. With, however, a simple scheme of designation, brief, clearly understood, and showing the relation of any particular location to the whole location scheme one has the requisites for effective handling of the problem.

An example of good practice in actual use is the system of lettering described in the instructions in Section IV. By the requirements of the case, each individual letter of any whole location symbol must be significant, not only in itself but in its relation to each other letter of the symbol. The first letter will indicate the largest division of any storage layout, such as a tract or field, a building, floor or section. Each succeeding letter will indicate some subdivision of the space indicated by the preceding letter. For instance, the first letter may indicate one of several storage buildings, the second a floor in the building; the third a section of that floor; the fourth a row of unit areas in the section; the fifth a unit area in the row; and the sixth a particular bin in a column of bins piled in tiers above the unit area.

A symbol will never contain more letters than there are regular divisions of space in the layout; it will contain only enough letters to indicate the particular area desired. For instance, in the above illustration, if the largest division of space is a building, the symbol for a floor would contain only two letters; that for a section, three letters; and so on.

Out of doors, terms must be given to areas the sizes of which increase up to several square miles. Hence, the definitions for different sized spaces given in Section I. As already indicated, it is thus possible to designate by not more than seven letters any regularly planned storage space of one square yard in a total area of 800 square miles.

For the actual sign-marking of given spaces, much must be left to local conditions and individual ingenuity. Out-of-doors, sign posts are almost essential. Indoors, floors may be lettered in the elevator shafts, and sections indicated by signs over their entrances. Sections and rows can frequently be indicated by painting the symbols on girders, cross-beams, or posts.

It is desirable to preserve flexibility in the use of marking, as to storage equipment. An example of good practice is the provision of metal holders for removable cards. A yellow card, bearing the symbol in black gummed letters (plain Gothic capitals) is inserted in the holder and may be changed according to need. For wooden bins, this card may be 3" long by 1 1-8" wide, insertible in a tin holder. (see Figure 6). Such a card will take four 7-8" letters, indicating section, row, unit, and tier. The holder would be tacked to the upper left corner of

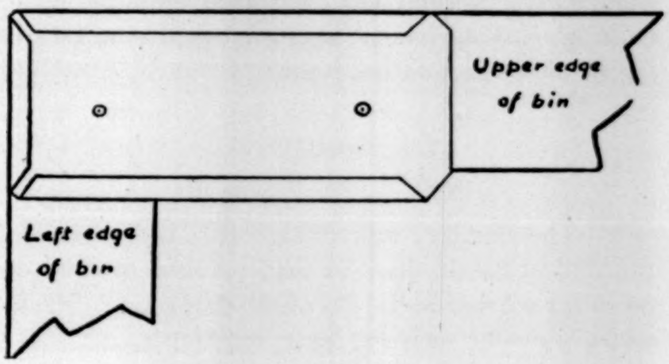


FIGURE 6

Metal holder for bin marker card.

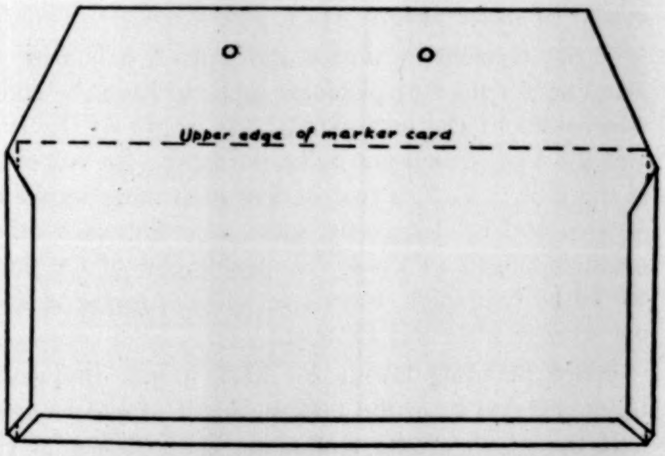


FIGURE 7

Metal holder for row marker card.

each bin. Metal bins would require some other provision such as a wire or small bolt for fastening the holder.

A similar holder for a card 5″ long by 2 1-2″ wide is used for rows. Such a card will take two 2″ letters, indicating section and row, or three indicating section, row and unit. (see Figure 7). It may be fastened to the aisle end of a row of bins, or hung over the end of a row of platform or floor units for heavy storage. The units composing a row for bulk or case storage seldom need be separately marked.

Permanence.

6. The lettering should be so arranged that in case of expansion the existing lettering will be the least disturbed. If possible, additions to a given layout should make normal and convenient additions to the existing marking scheme and not require the remarking of all or part of the layout.

2. LAYOUT

Standard unit storage area.

1. The standard unit storage area is the basis for the entire layout, just as the standard brick is the basis for a brick wall. To avoid confusion in the lettering, rows of such size as to require the splitting of the standard unit should be avoided, and may be if the unit is properly determined. For instance, if a unit is 3′ long, a row may be 12′ or 15′ long, but should not be 10′ or 14′ long.

If the rectangular unit is not square, it is wise in planning for floor or platform areas to have the short dimensions of the unit parallel the length of the row and the long dimension make its depth; for instance, if the unit is 4′x3′, a row of five such units would be 4′ wide and 15′ long,—the units adjoining each other on their longed (4′) side. A double row of ten units would be two single rows side by side, giving a storage area 8′ wide and 15′ long.

When planning layout for bins, it will frequently be possible to have the outside depth of the bin just half the depth of the unit area; for instance, if the unit area were 38″ x 38″, one unit area would hold 2 bins (Q. M. C. standard package 38″ x 19″ x 15″) back to back, resting on the 38″ x 19″ side. A single row of unit areas would thus serve, without loss of space, for a double row of bins opening on the 38″ x 15″ side. A floor or platform layout for bulk or case goods, planned with such a unit would provide for a double row of units which would make the maximum storage space 76″ deep. (see Figure 5).

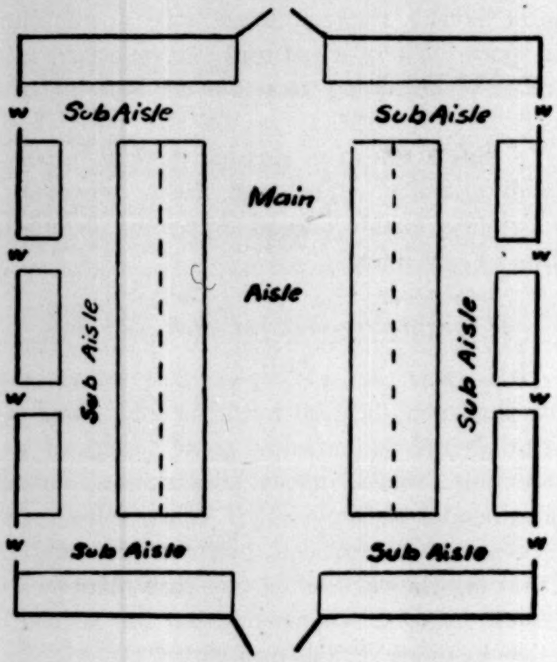


FIGURE 8

Incorrect layout. Four walls lined with storage space.

Sub-aisles on each side of every double row, whether of platforms or bins, give the necessary direct accessibility to every storage space. In general, a layout planned with standard unit areas is flexible, affording the desirable possibility of using the same space at different times for different purposes without upsetting the existing plan. The ability to adapt a layout to changed condition is always advantageous.

Crosswise rows.

2. Crosswise rows have the following advantages over lengthwise rows in oblong buildings or sections:

a. *Visibility* and ease of locating given rows.

b. *Main aisles* running the length of the section or building are *free for passing,*—all handling of goods being done in the side aisles.

c. *A greater number of separate aisle spaces* for handling goods. In a storehouse 40′ x 300′ the crosswise arrangement gave 64 secondary or side aisles for the handling of materials in the rows, as against 16 secondary or side aisles in a lengthwise arrangement. Under those circumstances, the chance of two men interfering by working in the same aisle at the same time was only one quarter as great in the crosswise arrangement as in the lengthwise. It is also clear that the crosswise arrangement, by its larger number of shorter sections, gives greater flexibility for storing a variety of items. It also gives opportunity for concentrating large quantities of a single item in the sub-aisles where necessary. For the use of sub-aisles for storage, see Part II.

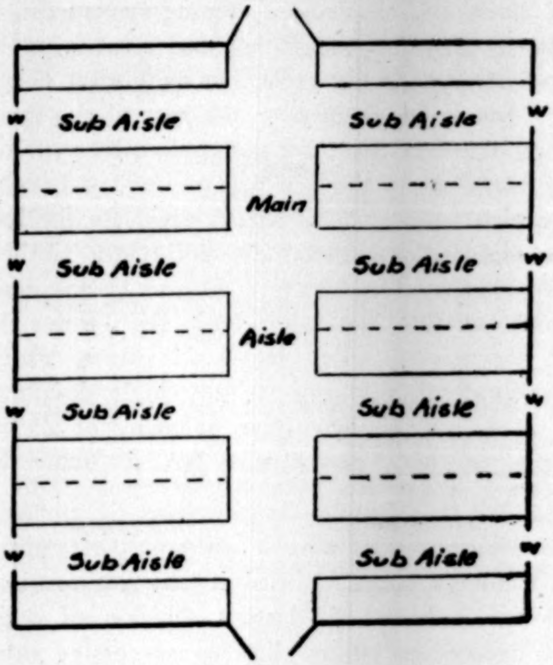


FIGURE 9

Correct layout. Parallel rows.

d. *Better lighting.* The sub-aisles afford a chance for the greatest effectiveness of windows on the long sides. With goods or bins piled high on lengthwise rows, the first row away from the wall may be well-lighted, but it shuts off the light for the other rows within.

e. *Reduced fire hazard.* The side aisles, giving frequent access to walls, increase the possibility of getting at a fire in it early stages. Fire passages along the walls become of less and sometimes of negligible importance. (See Figure 4 for layout including fire passage along walls.)

Parallel rows in any given section.

3. Any necessary change in the direction of rows should properly determine a new section as it is difficult to number consistently the rows in a single section if they run in different directions. The common tendency to line all four walls or boundaries with storage spaces is to be avoided. (see Figures 8 and 9.) If such a condition is found ready made it should be treated as an "exception" and remedied at the first opportunity. This is not always easy where shelves or racks are built in—another argument in favor of inter-changeable unit bins. If you start with the rows running east and west, all the rows in that section should run parallel to them. This is desirable for the sake not only of ease in numbering, but also for economy of space. Only by uniform parallel rows can the maximum percentage of storage to total area be secured.

Straight lines and right turns for aisles and rows.

4. City block scheme. Uniformity of plan increases economy of space. The less uniform the plan the larger the proportion of aisle space needed to give direct accessibility to each storage area.

Aisles.

5. The determination of the proper width of aisles, of course, depends entirely on the size of conveyors of material and of the bulk of the material itself. Care should be taken to see that main aisles are wide enough for two-way passing while sub-aisles are wide enough only for the work to be done in them, such as for a given truck to turn around. Aisles should not be so wide as to allow "parking space" for trucks. Aisles should always be kept clear for traffic, standing space for idle trucks being provided in regu-

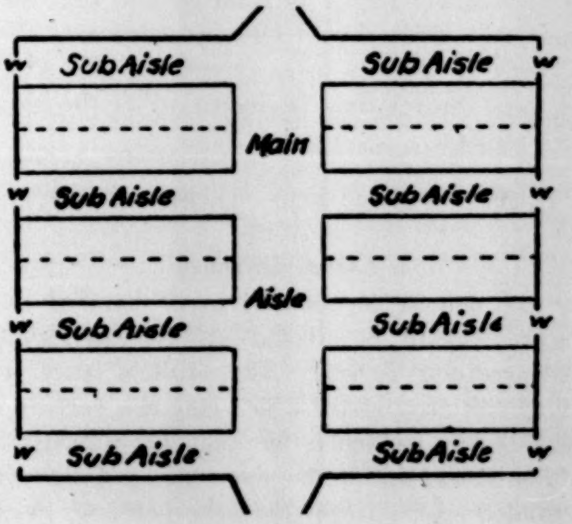


FIGURE 10

Incorrect layout. Six rows, four narrow sub-aisles.

larly designated "truck stands" (for single trucks) and "truck stations" (for several trucks) outside of aisles.

Floor space along a wall should not be used for an aisle if it can be planned for storage. Walls furnish natural supports for material and natural boundaries for sections, and if an aisle goes along the wall it is clear that that aisle can serve directly only one row of storage space across from the wall. Obviously, if every aisle can be made to serve two rows of storage units, one row on either side, the proportion of aisle to storage space can be kept at a minimum. (see Figures 10 and 11.)

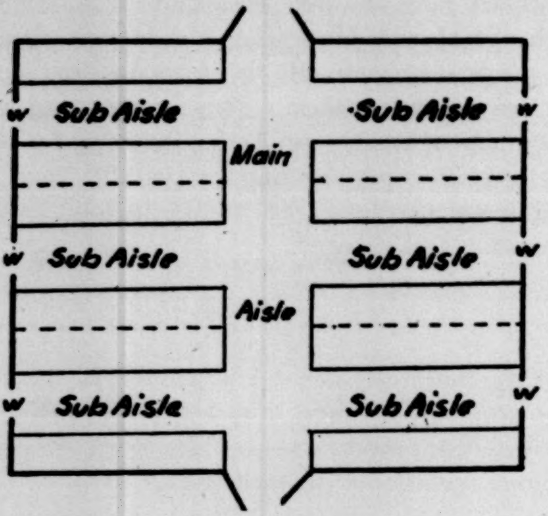


Figure 11

Correct layout. Six rows, three wide sub-aisles.

Aisles should occur frequently enough to give reasonably prompt access to each unit, avoiding unnecessarily roundabout trips. A good general rule for indoors is that aisles should intersect rows not oftener than every 15′ or less often than every 25′. Out-of-doors these figures may be increased as the circumstances warrant.

IV. INSTRUCTIONS FOR MARKING STORAGE SPACES

1. Layout Divisions

For the definite location of every item of stores, the stores layout is divided into spaces definitely graded according to size. The smallest space is the standard unit area, above which may rise verticle tiers of bins. (Any particular bin may have subdivisions which, however, will not be given special designation). The graded spaces larger than the unit are, in order of size, the row, section, series, field, range and tract, definitions for which will be found in Section I.

2. Symbols

Mnemonic System.

The mnemonic or memory-helping system of letter symbols is used for classifying and identifying locations. Each part of the symbol is significant not only in itself but in its relation to the rest of the symbol. The first letter is the most comprehensive; each following letter limits those which precede and includes those which follow. The letters used are the letters of the alphabet, capitals only, and plain Gothic so far as possible. The letters I, O and Q are omitted to avoid possible confusion with the figures 1, 0, and 2 respectively. This leaves 23 letters, affording 23 coördinate subdivisions to any single designation. Thus, a section, B, may have as many as 23 rows, BA, BB, BC, etc.; and a row, BA, as many as 23 units, BAA, BAB, etc.

Each storage space is identified by a symbol. The first letter indicates the largest division of a given layout, succeeding letters showing successive subdivisions. Only as many letters are used as are needed to indicate the particular space.

3. Lettering

Direction of expansion.

a. Probable direction of future expansion is the most important factor in determining from which point or boundary the lettering of any one set or group of spaces should begin. (see Figures 12 and 13.)

Topography, natural bounds such as walls, aisles, roads, embankments, or streams, and the like, will play a part in determining such expansion.

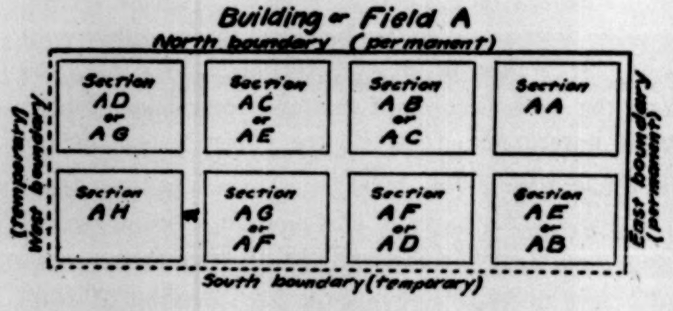


Figure 12

Incorrect marking of sections.

Probable expansion to west or south.

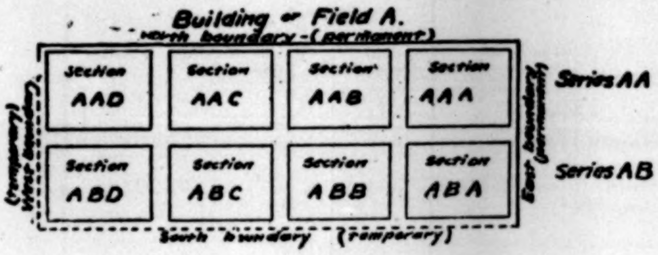


FIGURE 13

Correct marking of sections.
Probable expansion to west or south.

Consistency of direction.

b. By having the lettering run from A toward Z when lettering from north or east, and reversewise from Z toward A when lettering from the south or west, a general consistency of direction in all lettering is preserved, simplifying and increasing the usefulness of the marking scheme.

Vertical Divisions.

c. Tiers of bins and floors of buildings will be lettered from the bottom up, commencing with A at the bottom. A floor may contain one or more sections or, if large enough, one or more series of sections.

Areas.

d. Units, rows, sections, series, fields, ranges, and tracts will be lettered consecutively, commencing with A if lettering is done from the north or east, and reversewise, commencing with Z, if lettering is done from the south or west.

Buildings.

e. Buildings, if lined up uniformly, will be lettered consecutively like areas; if scattered irregularly, they may be lettered arbitrarily, either in sequence—A, B, C, D, etc., or so as to help the memory—as A for ammunition storehouse, C for commissary storehouse, E for equipage storehouse, F for forage storehouse, etc.

TABLE FOR LETTERING STORAGE SPACES.

Kind of Space:	Verticle Divisions	Square Areas (approx.)	Oblong Areas (rows of sq. areas)
Name of Space:	Tiers Floors	Units Sections Fields Tracts	Rows Series Ranges
Lettering of Space:	Letter from bottom up	Letter consecutively, commencing with A when lettering from the north or east and with Z when lettering from the south or west.	

Marking and layout within buildings already constructed will depend on existing conditions. These will vary so widely and be affected by such special conditions, as of traffic, light, entrances, partitions, posts, windows, and the like, that no definite rules can be laid down. Keeping in mind the general fundamentals will help one to make the best of situations really needing complete reconstruction for their full correction.

Partitions and solid walls especially are to be avoided except where necessary for the protection of the goods. The more open the floor space, the more advantageously can the layout be planned for both arrangement of items and economy of space. Walls and partitions generally make for inflexibility and involve unnecessary difficulties of layout and loss of space.

Where a standard storehouse with a standard layout can be adopted (such as Ordnance Depot Field Service Warehouse A or B) the lines of reference for marking within the building should be the walls of the building itself, rather than the points of the compass. Thus every warehouse of a given type however placed, will have uniform marking for its interior space.

In the case of each of the above standard warehouses, the position of the movable partition depends on the relative amount of material to be handled at either end. Therefore the direction of probable expansion for each section is *towards* the other section. Therefore the marking of the rows should commence at the outside end wall of each section and proceed towards the movable partition. In order to preserve consistency of direction, the lettering of rows should start with A in one section, and with Z in the other.

Allowances for incomplete rows.

f. If any row or other division is incomplete, allowance will be made in the lettering so as to preserve uniformity with complete rows. The letters representing the omitted spaces in the incomplete rows will be omitted. (see Figure 14).

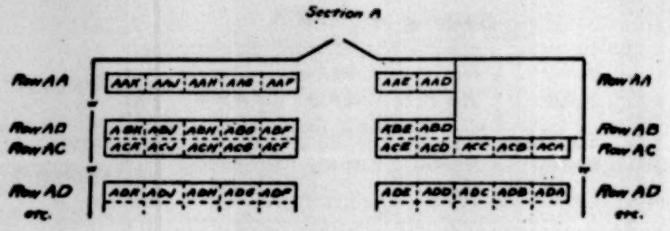


FIGURE 14

Correct lettering of incomplete rows.

4. PLANS

Plans or charts will be made to scale showing the marking and layout of standard or typical space divisions of all classes, including any variations from standard. As many copies as will prove useful both for local operation and for central control will be provided and kept up to date.

PART II. THE STORAGE OF THE STORES

The aim of Part II is to aid in decreasing the cost of handling stores, in increasing the rapidity of their inspection and the accuracy of their control, and in reducing spoilage due to careless methods.

The terms used in stowing have never been generally standardized. The meaning of such words as item, lot, unit, tier, block, stack, etc., are but vaguely comprehended, largely because of ambiguity in their use. The definitions given are offered as one step toward a generally recognized nomenclature, necessary for accurate instructions.

Designed for general use, the rules and principles here given are applicable to normal rather than special or exceptional conditions.

I. DEFINITIONS.

1—*Stowing:* The putting away of things, usually stores, in their proper places according to proper method. As the subject of this memorandum, it covers the larger ground of removal and general rules for handling.

2—*Item:* Any one kind of stores to be put in one place. e.g. *Canned corn,* No. 2 size cans, xyz brand. Difference in size, shape, nature, quality, weight, color, make, brand, or style, will generally determine different items.

3—*Lot:* A quantity received and stowed at any one time. e.g. *50 cases,* 24 in case, canned corn, No. 2 size cans, xyz brand.

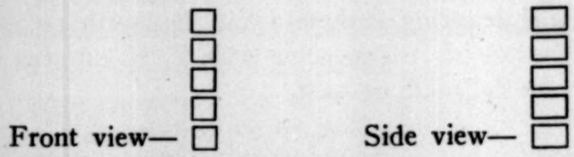
4—*Unit:* A quantity easily handled or normally issued at one time: e.g. Wholesale—*1 case,* 24 in case, canned corn, No. 2 size can, xyz brand. Retail—*1 can,* canned corn, No. 2 size can, xyz brand.

5—*Article:* Any single piece: e.g. *1 can,* canned corn, No. 2 size can, xyz brand.

6—*Pile:* A heap, irregular in shape. Regular piles are defined under column, stack, and block.

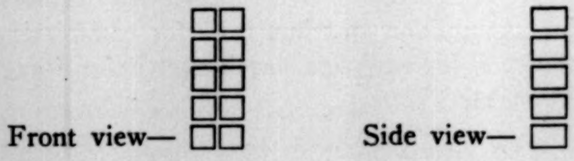
7—*Column:* A vertical, self-supporting, regular pile, one wide, one deep, two or more high.

e.g. *Column* of 5.

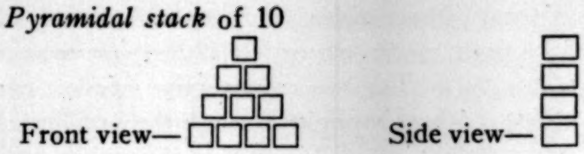


8—*Stack:* A self-supporting regular pile, two or more wide, one deep, two or more high. A stack may be either *cubical* or *pyramidal.*

e.g. *Cubical stack* of 10

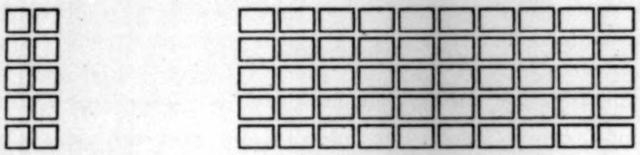


Pyramidal stack of 10



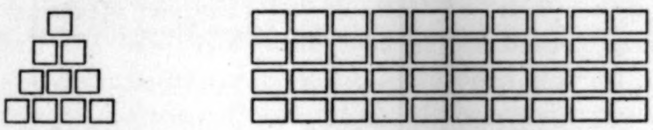
9—*Block:* A self-supporting regular pile, two or more wide, two or more deep, and two or more high. A block may be either *cubical* or *pyramidal.*

e.g. *Cubical block* of 100



1 stack of 10 End view 10 stacks Side view

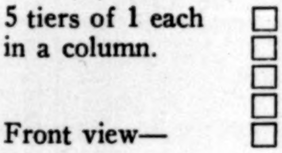
Pyramidal block of 100



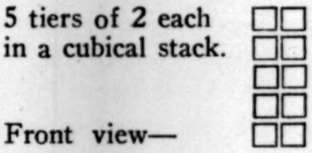
1 stack of 10 End view 10 stacks Side view

10—*Tier:* Any one separate part of a column, or a horizontal row of a stack. Tiers are numbered in the order of their stowing—from the bottom up.

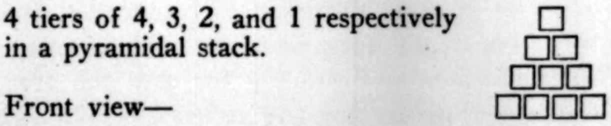
5 tiers of 1 each in a column.



5 tiers of 2 each in a cubical stack.

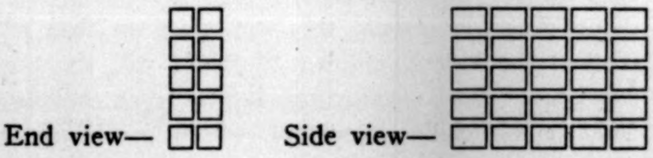


4 tiers of 4, 3, 2, and 1 respectively in a pyramidal stack.

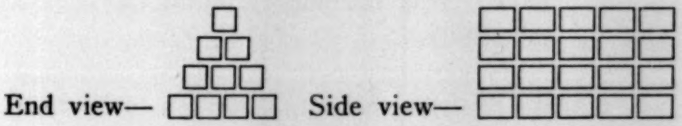


11—*Course:* A horizontal layer of a block (cf. the *courses* of a brick wall). Courses are numbered from the bottom up.

e.g. 5 courses of 10 each in a cubical block of 50.



4 courses of 20, 15, 10, and 5 respectively in a pyramidal block of 50.



II. FUNDAMENTALS

"A place for everything and everything *properly* in place."

1—*Definite spaces,* preferably marked, reserved exclusively for

a. Moving.
Aisles should preferably be straight, and only wide enough for actual requirements.

b. Stowing.

c. Receiving.
When necessary to hold material awaiting disposition.

d. Assembling.
When necessary to hold material awaiting delivery.

e. Shipping.
When necessary to hold material awaiting shipment.

2—*Identification,* clear and complete, of every item.

a. A tag for each lot.

b. A label on each unit or package, preferably on the end.

3—*Location* of an item governed by

a. Difficulty of handling.

b. Quantity to be carried.

c. Frequency of use.

d. Special considerations as of sensitiveness, perishability or peculiar similarity to other items.

e. Safety (floor strength, fire hazard).

4—*Immediate accessibility* of items, lots, and units, without rehandling.
This means

a. Goods will be stowed in issuable units.

b. Each item (and each lot where practicable) will be kept distinct. Therefore a unit of one item or lot will not be stowed on top of or in front of a unit of a different item or lot.

c. Goods will be placed so that the greatest number of individual units or packages will show. This facilitates counting, as well as accessibility.

5—*Standard methods,* defined in written instructions, of *placing and removing* various classes of items.

a. Uniformity—always piling the same item the same way, and in such a way that each full column, stack or block will contain the same quantity as each other full column, stack or block.
b. Distinct separation of each lot, so that old lot may be used first.

6—*Flexibility* in arrangement.

This is secured by having storage spaces rectangular, and in area whole multiples of a standard rectangular unit. Bins, platforms, and floor spaces will then be interchangeable.

III. DISCUSSION

1. Definite Spaces

Aisles must be kept clear.

The real reason for taking pains that stowing of stores shall be orderly and systematic is to be able to get at what is wanted when it is wanted, with the least possible expenditure of time and effort. This involves having what you want on hand in sufficient quantities and knowing where it is. The only way of getting at what is wanted is by means of the aisles and passageways provided for the purpose. It is axiomatic, therefore, that the aisles should be of only such width as is required for the necessary passing and handling of the goods to be stored. It is equally fundamental that they cannot be obstructed by things left standing in them or by the projection of things stored along their margins. The delay caused by unexpectedly encountering a blocked aisle is always wasteful,—likewise, the danger of damage to goods projecting from the proper bounds of either storage spaces or conveyors is obvious.

Aisle widths.

Aisles should be planned according to their use and the size of conveyors or materials to be handled in them. Main aisles for two-way passing of trucks may need to be six or eight feet, or even more in width, according to conditions. Side, connecting aisles, or those straight through the building, for one-way passing, need be only comfortably wider than the trucks to pass through. Blind side aisles, ending in a wall, if for trucking, normally should be wide enough to allow the truck to safely turn around. This is especially true where four wheel or elevating platform trucks are to be used. Thirty inches is a standard width for aisles between bins or shelves where the contents are package goods carried by hand.

Boundary lines.

Showing the boundary lines of aisles and likewise of storage, receiving, assembling, and shipping places is important in order that there may be no vagueness about the limits of the spaces required for each. The more permanent and conspicuous these boundary lines are made, the better. In buildings, lines two inches wide, of black or red paint, or of strips of zinc tacked to the floor, have been used effectively. The right amount of space in a well planned stores layout is essential. More than this amount is wasteful, whereas less than this amount for each particular purpose leads inevitably to congestion, and congestion must be avoided.

2. Identification

Symbols.

The clear and complete identification of each item is equally important. The same item must not be called by different names at different times; furthermore, the name of each item must be so distinctive that it cannot be confused with any other. This leads in many cases to the careful classification and symbolization of all items in stores. The symbol, being short, distinct, and standing for only one thing, is a convenient means for the accurate identification of stores.

Marks face out.

Identification marks on packages should preferably face out, or be conspicuous. Therefore the end of the package is usually the best place so that when stacked the largest number of labels will show, and furnish a check against packages being misplaced. This is especially important where goods are not tagged. The labelling of individual packages is not so necessary when lots are systematically tagged and placed in definite locations indicated by symbol both on the identification tag and on the balance records.

3. LOCATION

General considerations.

The elements determining the location of an item are sometimes conflicting. Of course, a large, heavy item, difficult to handle, should be given the shortest possible haul. Similarly, an item easy to handle but carried in large quantities and very frequently used, should be in a convenient location with short haul. The same is true of items which, when issued, have to be specially measured, such as bar-stock, or syrup in barrels.

Special considerations.

There may be, of course, special considerations such as the sensitiveness of explosives, the perishability of meat or other food stuff, or peculiar similarity such as of pipe and bar stock which would clearly point to the necessity of stowing those items together. Whether the location under those circumstances is most convenient is generally secondary to the particular equipment necessary for their proper care. It is sometimes found economical to stow near each other special parts or articles of equipment which are regularly issued together in a group. It is also desirable to keep unserviceable articles separated from serviceable.

Safety.

The stresses which floors will stand must of course be known and allowed for. Whether fire-passages (of 2 ft.) along all walls should be left, depends on local conditions and the nature of the goods. In general, fire-passages are more necessary with block piling, or where stacks run parallel to and adjoin the walls. Fire-passages are less necessary when stacks, with side aisles between every two, run at right angles to walls. In the latter case, the side aisles give direct access to wall space every few feet, and packages next the wall in any given stack may be easily and quickly removed.

4. ACCESSIBILITY

Issuable units.

The immediate accessibility of each lot of every item only emphasizes in a different way the fundamental general purpose of stowing, namely, to get at what you want when you want it with the minimum expenditure of time and effort. This means that goods should be stowed as nearly as possible in the units in which they will be issued, even though this requires the breaking of the units in which they are received. This is based on the fact that the time element required for unpacking is less important when the goods are first received than when they are called for issue. As a precaution against unnecessary loss from depreciation, it is obvious that the stock should be kept moving by always using the old lots first.

5. STANDARD METHODS

In writing.

The importance of establishing in writing some defined methods of placing and removing the various classes of items need not be emphasized. The very effort to determine the methods forces attention and decision for the time being, at least, on the one best way under the circumstances. More than that, it is true that the consistent following of even a poor standard brings better results than the haphazard and uncertain following of the best of standards. The more completely a poor rule is followed, the more clearly will its failings be revealed and the better can it be revised.

Neatness. Exceptions conspicuous.

Standard methods for piling each class of goods will insure neatness and uniformity. Then the exceptions to good piling, by their very conspicuousness, will be their own signal for correction. "Publicity is a potent factor in keeping things right." Therefore, unnecessary covers, doors, and other protections, behind which wrong practice may be concealed should be avoided.

More accurate inspection and count.

Besides leading to precision in handling and making carelessness more noticeable, such uniformity greatly facilitates the accuracy and speed of inspection and count. So far as possible, stores should indicate their own count. Hence the importance of uniformly regular columns, stacks and blocks. This is the chief reason for preferring cubical to pyramidal piling. The quantity in a full pyramid may be calculated by mathematical formula but difficulties are apt to arise as soon as part of the pyramid is removed. "How much is left" is an all-important question and it should not be necessary to count each article to find out. Piling in uniformly regular columns, stacks, and blocks, with only one last block, stack, column or package containing an odd quantity, is the simple solution of this problem.

Decimal units.

For the same reason, the use of easily calculated decimal units for the quantities in blocks, stacks, columns, and sometimes packages, is desirable. The instruction specifying that piling may be done in single units up to 10 and after that only in multiples of 5 illustrates the point.

Double space.

The allotment to each regularly carried item of double the space needed for each regular lot of the item received is, where sufficient space is available, well worth while. It insures accuracy and simplicity in handling the different lots, each being kept separate and the old lot always being used first. It also results in less frequent need of locating parts of the same item in different places. Where only the single space required for a lot is reserved for it, and a new lot comes before the old lot is used up, it is often necessary to put part, if not all, of the new lot somewhere else, there being no room for it in the space with the old lot. This process, repeated often enough, leads to a constant shifting of the location of given items and results in confusion. In some cases where the storekeeper is responsible for the quantities on hand, he loses sight of some portions of an item and calls for more before he really needs it. This means unnecessary investment and the added liability to loss from spoilage. Some plants have found that the cost of the double space system suggested above was well repaid by protection against such loss. The less intelligent and skilled the help, the greater is the usefulness of the double space system. It is more nearly "fool-proof."

6. FLEXIBILITY

Unit storage spaces.

In few live organizations are conditions the same year after year; in some, the conditions change materially season by season. Hence the importance of flexibility in the arrangement and use of storage equipment. The determination, even at some effort, of a standard rectangular storage unit as the basis for the lay-out of the stores plant is a great help in obtaining this flexibility. Bins, platforms and floor spaces can then be made to correspond to this unit and so be interchangeable. Thus, without affecting in any way the general plan and lay-out, the particular equipment in use may be shifted to meet varying conditions.

Bin sub-divisions.

The same principle applies to the subdivision of bins and will lead to the adoption of a standard unit bin of such inside dimensions that it will hold the greatest variety of standard removable subdivisions. For instance, a bin 24½" x 24½" x 18" inside, opening on the first two dimensions, gives opportunity for a wide variety of subdivisions 18" deep whose other two outside dimensions will be even fractions of 24".

Emergency bins.

For emergency use, bins may be improvised by stacking empty packing cases of uniform size back to back. Such double rows should preferably run at right angles to the long side of the building.

7. PLANNING

The importance of accomplishing the most with every man-hour of labor as well as every dollar of expense in the nation's work of winning the war is the measure of the importance of careful stowing. Hours of labor and dollars of expense can be avoided by intelligent planning ahead. The storekeeper must pre-determine and control his results instead of letting conditions take him by surprise and find him unprepared. Where he has the planning of new storage areas he will find it pays, for best results and a minimum waste of space and operating expense, to observe the following sequence:

Method for planning new areas.

(a) The listing and classification of all items according to

1. Measurements
2. Difficulty of handling
3. Frequency of use
4. Special considerations, as of sensitiveness, perishability or of peculiar similarity
5. Quantities to be carried

(b) Determination of proper unit storage space

(c) Determination of proper aisle spaces

(d) Determination of proper lay-out of storage and aisle space with general location of items and calculation of total space needed.

(e) Lastly, the planning of structures so that entrances, aisles, posts, platforms, windows, and other necessary features will not interfere with but will facilitate the most desirable lay-out of the stores themselves.

IV. GENERAL INSTRUCTIONS FOR HANDLING STORES

1. COUNTING

Before or during stowing.

1. All goods will be counted before or during stowing, and the quantity entered on the tag.

2. PLACING

Storage space.

2. Stores are stowed only in the spaces reserved for the purpose. This means that window sills, ledges, floors, aisle spaces, etc., are not to be used either permanently or temporarily for keeping goods unless the tag on the goods bears the signature of the proper official authorizing the use of such space for that purpose. Tools or equipment in regular use in store rooms will be provided with special places, marked so as to show the purpose for which reserved.

Space for one item.

3. The space allotted to any one item will be enough to hold the maximum expected on hand at one time, with each lot distinct. E. g., if the normal lot would occupy 1½ rows, and usually arrives when 1-3 of the previous lot (or ½ row) is left, the total space reserved for the item would be 2 rows. (See Figure 15.)

Placing.

4. The placing of any item of stores depends on the shape and character of the article, and the nature of the storage place. On the floor are placed cases of such size and weight as to be apt to break a platform in handling. All other stores except those stowed in bins or on racks are placed on platforms. These are largely goods of bulk and weight, such as sometimes require more than one man to handle and

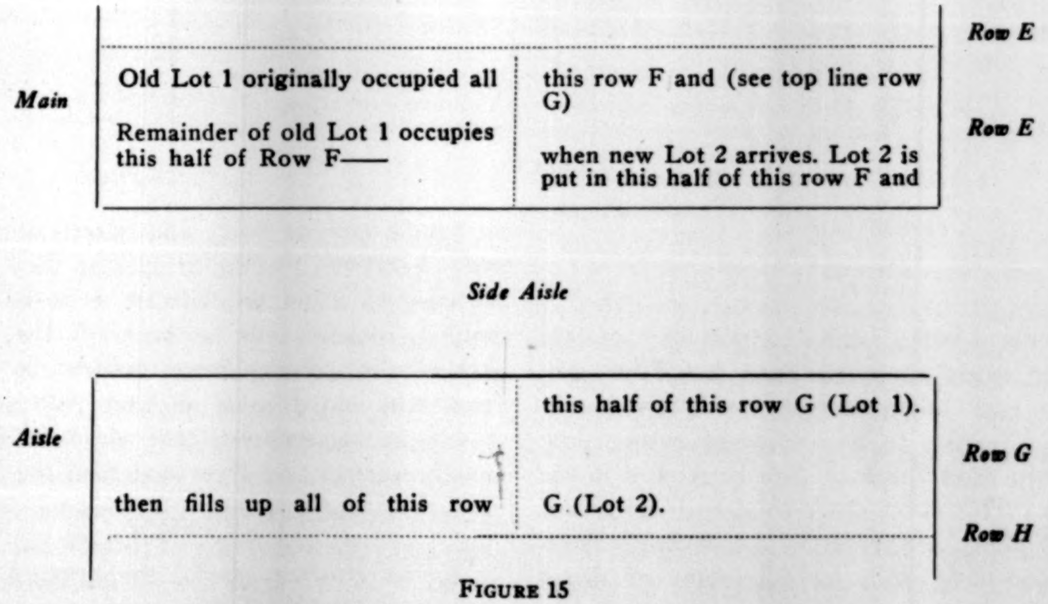

Row E
Main
Old Lot 1 originally occupied all
this row F and (see top line row G)
Remainder of old Lot 1 occupies this half of Row F——
Row E
when new Lot 2 arrives. Lot 2 is put in this half of this row F and
Side Aisle
this half of this row G (Lot 1).
Aisle
Row G
then fills up all of this row
G (Lot 2).
Row H

FIGURE 15

pile, (e.g., barrels, bags, bales, bundles, and ordinary cases and crates). Small stores, such as those in small boxes, cartons, and packages, and loose supplies are put in bins. Articles of unwieldy length, like iron piping, are placed on racks.

Accessibility.

5. Goods will be placed so as to be as easily accessible as possible, those more frequently used being in the handier locations.

Minimum handling.

6. Consistent with the above, they will be placed so as to require as little handling as possible in receiving, stowing and removing. Old lots should not have to be disturbed when new lots are placed. Other things being equal, heavy bulky goods will have the shortest haul.

3. CONCENTRATING

Rows.

7. In stowing a bulky item of stores in quantity, effort will be made to concentrate it. Thus two rows opposite each other (across a side aisle) will be filled in preference to two adjacent rows. Any excess over two rows full may then be stowed in the aisle between. This saves space to almost the extent of solid block piling, yet preserves the desirably flexible row arrangement with its maximum of direct accessibility.

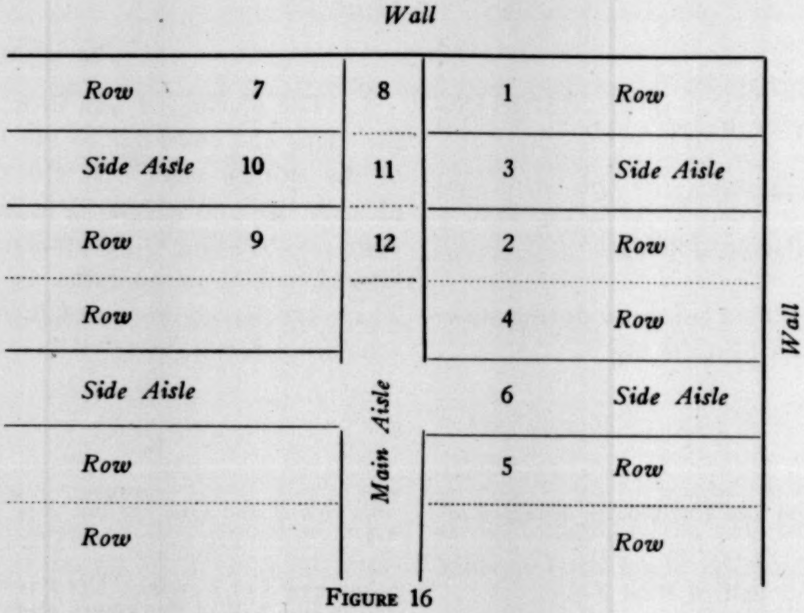


FIGURE 16

Side Aisles.

8. Side aisles may be used for stowing only when the rows on either side are full of the same material.

Main Aisles.

9. Main aisle space adjoining a wall may be filled out to parallel full rows and aisles of the same material on either side. Platforms will when practicable, be placed for goods stowed in aisles.

Figure 16 illustrates the order in which rows and aisles may be filled with large lot of one item. Removals will be in reverse order. (See paragraph 24).

4. FILING

Spoilage.

10. Articles should never be stowed in a position which might cause injury to them. Thus sheets of unprinted paper should lie flat, brooms should stand on handle end, or hang, and barrels should stand on end. Likewise, placing articles so they project from the edge of a bin or platform is to be avoided. In general, articles will be kept off the floor or the ground. In placing items subject to deterioration from heat and dryness or from cold and dampness, it will be remembered that air near the ceiling is usually warmer and dryer than near the floor.

Height.

11. In stowing goods, the greatest economy of space is secured by tiering in cubical stacks and blocks

as high as is consistent with stability, thus leaving a maximum area for different groups and kinds of articles. Where economy of space is not critical, economy of time and effort are more important, and goods will be tiered only as high as an ordinary man can reach. Five feet to the top of the next to last tier is a normal height for packages not exceeding 100 lbs. As far as possible men should work singly, rather than in groups.

Shape—Cubical vs. pyramidal.

12. Where it is possible to choose between cubical and pyramidal piling of goods, the cubical method will be given preference.

Cubical piling has the following five advantages:

1. More economical in use of space.
2. Easier to keep uniform and regular.
3. Easier to inspect.
4. Easier to count.
5. Less spoilage from weather, if uncovered.

Pyramidal piling has two advantages:

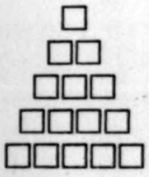
1. Simpler and easier to secure stable tiering of cylindrical or other rolling articles, such as shells, by bracing the bottom tier only of each stack. Cubical tiering of such goods requires bracing the stack all the way up.

2. Easier to cover from weather, because of its shape like a peaked roof.

Where pyramidal piling is a necessity,
No. in full stack=

$$\frac{\text{No. on bottom tier x (No. of tiers} + 1)}{2}$$

E.g. For a full pyramidal stack with
5 in bottom tier



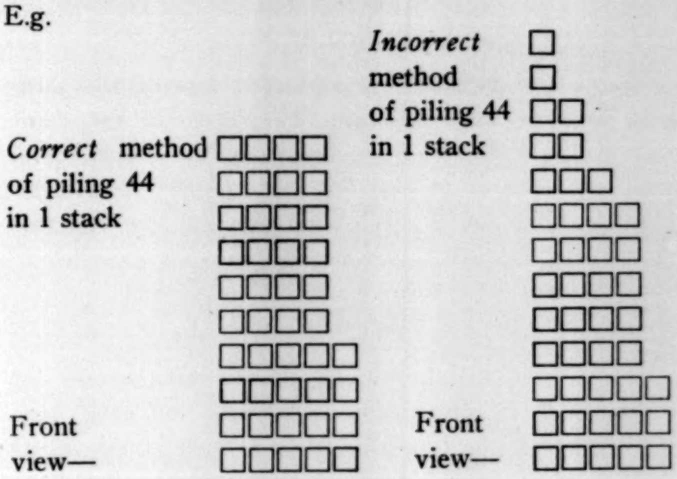
$$\text{No. in stack} = \frac{5 \times (5+1)}{2} = \frac{5 \times 6}{2} = \frac{30}{2} = 15$$

The number in any block, whether pyramidal or cubical, will be the number in one full stack times the number of full stacks in the block.

Uniformity.

13. Full columns, stacks or blocks of any one item will be kept uniform for that item. Only the last column, stack or block may remain incomplete, containing odd quantities. This will add both to neatness, and to ease and accuracy in counting.

E.g.



Group Piling.

14. Stores are piled singly or in multiples of five. Goods may be piled singly up to ten in a column. Beyond this the columns are made as high as the space will permit but of whole groups of five only. Groups are not broken to fill in a remaining space too small for a whole group. Thus every column of articles small enough to be piled in groups of five will contain some multiple of five and will be uniform for that article. For instance, if a bin holds 24 packages of letterheads piled snug to the top, the column will be made of 20 packages only, viz., 4 groups of 5 each.

Stowing Area.

15. In any area to be filled, such as a platform unit, stowing is commenced at the back left-hand corner, and brought forward, each row of goods being completed to the front before a new row is started. Tiering is done as soon as the nature of the goods permits and as high as possible so long as the stacks are stable, the uniform groups are preserved, and the stack does not come too near the ceiling. Space will be left for the proper working of the sprinkler pipes (in this case . . . inches), and for properly removing (such as by upending) the goods on the top tier.

Stowing volume.

16. In any cubic space to be filled, such as a bin, stowing is commenced at the back left-hand corner,

and carried on vertically until one column is completed. This is made the first of a row of such columns brought to the front and completed. The second row of columns will commence as did the first, in the farthest left-hand corner of the remaining available space, and be built up and forward in the same manner.

Separation of lots.

17. Different items or different lots of the same item will be kept distinct. If placed in the same storage space, they will be separated by a space of at least one inch if in bins, or three inches if on platforms. Each lot of each item has its own separate tag and lot number.

Direction.

18. Goods will be placed all one way unless for stability it is necessary to reverse or cross-pile. *Reversing* will be done singly or in groups, according as the goods are piled singly or in groups, the same dimensions, however, lying the same way *Cross-piling,* or laying goods in each tier or course at right angles to those just below, while increasing stability, decreases accessibility and sureness of count. As stability is generally less vital than accessibility and flexibility, cross-piling will be resorted to only in special cases. Where ventilation is required, as in piling lumber, cross-bars separating each course will be used. Thus the goods in all the courses may still lie all one way. The best way in general for goods to lie is with their ends out towards the aisle into which they will be withdrawn. If, however, space is economized to a marked degree (at least 25%) by placing the goods in some other way, it may be done.

Labels.

19. Labels, or other means of identification, will be placed all one way, showing outward if consistent with other rules.

Wrappings.

20. Articles with defective wrapping will be placed last, in order that they may be removed first. The person stowing goods is responsible for seeing that the tying or wrapping on packages is in as good condition as his facilities enable him to secure. This includes the putting on of new wrappings when necessary and feasible.

Maximum.

21. The maximum quantity ordinarily stowed will occupy not more than 75% of the space available. The remaining space is reserved for times of special need.

5. Removing

Parts of one lot.

22. In removing goods from storage, in any one lot the last goods to be put in place are removed first, and further removals are made in just the reverse order to that in which they were placed. This means the cleaning up of incomplete before complete columns, stacks and blocks are touched.

More than one lot.

23. In the case of more than one lot of any one item, the lots are drawn from in order of age commencing with the oldest, unless otherwise specified on the issue. Not until all the goods of one lot are removed from any part of a storage space and the tag removed, is that part available for stowing a new lot.

Goods concentrated in aisles.

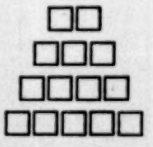
24. Where goods have been concentrated by stowing in side aisles between regular storage rows, (see paragraphs 7-9), removals will be made first from aisles spaces. No goods will be removed from a regular row until adjoining aisle spaces have been entirely cleared.

Pyramidal blocks.

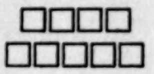
25. Removals from a pyramidal block will not be from the side slopes or from along the top, but will be stack by stack from the front. Thus there will be not more than one incomplete stack at any one time, all stacks behind the front one being complete. Removals from any one stack will be tier by tier from the top, so as not to disturb existing stability, or any braces at the bottom tier.

E. g.

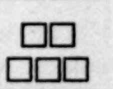
Full Stack of 15



Correct removal of 6, leaving 9



Incorrect removal of 6, leaving 9



A. F. OF L. RESOLUTIONS

AMONG the two hundred and more resolutions introduced at the thirty-ninth annual convention of the American Federation of Labor (Atlantic City, June, 1919) the following are of especial interest as having a direct bearing on management:

Resolution No. 50 (not passed).

WHEREAS, Union men must function in a way to benefit the laboring class as a whole or go down in defeat; and

WHEREAS, A great portion of the abuses which are imposed on the laboring class by the employing class could not be successfully practiced were it not for the custom now established of keeping overseers and foremen in charge of work who are entirely heartless and disregardful of the welfare of the workers; and

WHEREAS, The producers of wealth have as much right to decide who shall direct their labors as has the employer; therefore be it

RESOLVED, That on and after May 1, 1920, the workers in any industry shall have the privilege, and are encouraged to demand the right, to "elect" the foreman under whom they shall work, by a majority vote of the entire force of the employees engaged in that industry.

Resolution No. 94 (passed).

WHEREAS, Scientific research and the technical application of results of research form a fundamental basis upon which the development of our industries, manufacturing, agriculture, mining, and others must rest; and

WHEREAS, The productivity of industry is greatly increased by the technical application of the results of scientific research in physics, chemistry, biology and geology, in engineering and agriculture, and in the related sciences; and the health and wellbeing not only of the workers but of the whole population as well, are dependent upon advances in medicine and sanitation; so that the value of scientific advancement to the welfare of the nation is many times greater than the cost of the necessary research; and

WHEREAS, The increased productivity of industry resulting from scientific research is a most potent factor in the ever-increasing struggle of the workers to raise their standards of living, and the importance of this factor must steadily increase since there is a limit beyond which the average standard of living of the whole population cannot progress by the usual methods of readjustment, which limit can only be raised by research and the utilization of the result of research in industry; and

WHEREAS, There are numerous important and pressing problems of administration and regulation now faced for Federal, state and local governments, the wise solution of which depends upon scientific and technical research; and

WHEREAS, The war has brought home to all the nations engaged in it the overwhelming importance of science and technology to national welfare, whether in war or in peace, and not only is private initiative attempting to organize far-reaching research in these fields on a national scale, but in several countries Governmental participation and support of such undertakings are already active; therefore be it

RESOLVED, By the American Federation of Labor in convention assembled, that a broad program of scientific and technical research is of major importance to the national welfare and should be fostered in every way by the Federal Government, and that the activities of the Government itself in such research should be adequately and generously supported in order that the work may be greatly strengthened and extended; and the Secretary of the Federation is instructed to transmit copies of this resolution to the President of the United States, to the President pro tempore of the Senate and to the Speaker of the House of Representatives.

Resolution No. 154 (passed).

WHEREAS, The Post Office Department has in operation systems to measure the speed and efficiency of the Postal Employees; and

WHEREAS, These systems are calculated to force the employees to maintain a speed and standard that is unreasonable and detrimental to their welfare and health; and

WHEREAS, In practice, these systems have resulted in unreasonable punishment and discrimination against the employees; therefore be it

RESOLVED, That the American Federation of Labor in Convention assembled condemns this policy, and asks the Executive Council to render all possible assistance to abolish present unreasonable speed tests, time-measuring devices and present unreasonable standards of personal efficiency in the postal service.

Resolution No. 180 (endorsed and referred to the Executive Council).

WHEREAS, There is now pending before the American people and their representatives in Congress the political solution of the railway problem; and

WHEREAS, Every human and industrial activity, the life of every community, and the happiness and the prosperity of every citizen are dependent upon the solution of this problem; and

WHEREAS, It is demanded by the private owners of these properties as the condition on which they will resume the control and operation thereof, that the people of America guarantee them privileges which they have not heretofore enjoyed, to wit, the right to earn a guaranteed return on the property investment account of the railway companies; and

WHEREAS, Such a guarantee would make valid as a direct obligation of the people of the United States all fictitious securities, stock dividends, and discounted bonds issued by the railroads without consideration and representing no service to the American people; and

WHEREAS, To make good such guarantee, rates must be raised far in excess of the level now fixed, or, in default of such increase in rates, wages must be reduced far below the level now fixed, or both; and

WHEREAS, There has been presented to the Senate Committee on Interstate Commerce, and will shortly be introduced in Congress the plan for a reorganization of this industry originating with the railway employees; and

WHEREAS, Labor's plan so presented provides for immediate public ownership of these properties, the protection of every honest dollar actually invested, and the assurance of an adequate return on such investment without any increase in rates; and

WHEREAS, Labor's plan provides for joint control of the industry through a Board of Directors representing equally the wage earner, management, and the public; and

WHEREAS, Said plan guarantees to the public the protection of its interests in procuring ultimately service at cost, and at the same time secure to the wage earner a fair share of the profits produced by his skill, efficiency and economy; and

WHERAS, Labor's plan provides for the full protection of all the rights and privileges of the wage earners as a class without invading the rights of any other classes of society, and at the same time throws wide the golden gate of opportunity for the full development of the powers of initiative, inherent to every individual; now, therefore, be it

RESOLVED, By this Thirty-ninth Convention of the American Federation of Labor that we hereby approve, endorse and adopt the plan for the re-organization of the railway industry, presented to the Senate Committee on Interstate Commerce on behalf of the Railroad Employees represented by the following organizations: International Association of Machinists, Brotherhood Railway Clerks, Brotherhood of Locomo-Railway Carmen of America, International Brotherhood Blacksmiths and Helpers, International Brotherhood of Electrical Workers, Brotherhood Railroad Trainmen, Switchmen's Union of North America, Brotherhood Railway Clerks, Brotherhood of Locomotive Engineers and Enginemen, Sheet Metal Workers' International Alliance, Order Railroad Conductors, Order Railroad Telegraphers, United Brotherhood Maintenance of Way and Railroad Shop Laborers, International Brotherhood Boilermakers, Iron Shipbuilders and Helpers of America, by A. B. Garretson, Grand Chief of the Order Railroad Conductors and Glenn E. Plumb, their counsel; and, be it further

RESOLVED, That we hereby pledge ourselves to use every legitimate endeavor to promote the enactment of this plan into law.

BRIEF BIBLIOGRAPHY OF MANAGEMENT

THIS list has been prepared, as the result of numerous inquiries, for industrial establishments which desire to make available for their administrative staffs and workers, a small library of the best books on management. A more extended list may be issued later by the Taylor Society. In the meantime, institutions desiring to establish a complete library on management, are referred to Brown's *Scientific Management: a list of references in the New York Public Library* (Bulletin of the New York Public Library, Jan.-Feb., 1917).

Annals of the American Academy of Political & Social Science: Philadelphia.

Arnold & Faurate, *Ford Method and the Ford Shops*: New York. The Eng. Mag., 1915.

Babcock, George D., *Taylor Principles in Franklin Management*: New York. The Eng. Mag., 1911.

Bloomfield, Meyer, *Management and Men*: New York. Century Co., 1919.

Brandeis, Louis D., *Scientific Management and Railroads*: New York, The Eng. Mag., 1911.

Brinton, Willard C., *Graphic Methods of Presenting Facts*: New York. The Eng. Mag., 1914.

Bulletin of the Taylor Society: New York. 29 W. 39th St.

Chief of Ordnance, U. S. A., *Reports for 1911, 1912, 1913.*

Church, Alexander H., *The Proper Distribution of Expense Burden*: New York. The Eng. Mag., 1908.

Colvin, F. H., *Labor Turnover, Loyalty and Output:* New York. McGraw-Hill Book Co., 1919.

Commons, John R., *Industrial Good Will:* New York. McGraw-Hill Book Co., 1919.

Cooke, Morris L., *Our Cities Awake*: New York. Doubleday, 1918.

Cooke, Morris L., *Academic and Industrial Efficiency:* New York. Bulletin No. 5, of the Carnegie Foundation.

Day, Charles, *Industrial Plants; their arrangement and construction:* New York. The Eng. Mag., 1911.

Diemer, Hugo, *Factory Organization and Administration:* New York. McGraw-Hill Book Co., 1916.

Drury, Horace B., *Scientific Management:* New York. Columbia Univ. Press., 1915.

Emerson, Harrington, *Efficiency:* New York. The Eng. Mag., 1909.

Emerson Harrington, *The Twelve Principles of Efficiency*: New York. The Eng. Mag., 1912.

Evans, H. A., *Cost Keeping and Scientific Management:* New York. McGraw-Hill Book Co., 1911.

Gantt, Henry L., *Industrial Leadership*: New Haven. Yale Univ. Press, 1916.

Gantt, Henry L., *Work, Wages and Profits:* New York. The Eng. Mag., 1913

Gilbreth, Frank B., *Motion Study*: New York. D. Van Nostrand Co., 1911.

Gilbreth, Frank B., *Primer of Scientific Management:* New York, D Van Nostrand Co.

Goldmark, Josephine C., *Fatigue and Efficiency*: New York. Charities Pub. Comm. (Russell Sage Foundation), 1912.

Hartness, James, *The Human Factor in Works Management*: New York. McGraw-Hill Book Co., 1912.

Henderson, Arthur, *The Aims of Labor:* New York. Huebsch, 1918.

Industrial Management Magazine: New York.

Jones, E. D., *Administration of Industrial Enterprises:* New York. Longmans' Green, 1916.

Knoeppel, Charles E., *Installing Efficiency Methods:* New York. The Eng. Mag., 1915.

Leffingwell, W. H. *Scientific Office Management*: Chicago. A. W. Shaw Co., 1917.

Parkhurst, Frederick A., *Applied Methods of Scientific Management*: New York. John Wiley & Sons, 1912.

Personnel Management: in *Annals of the American Academy of Political & Social Science.* Philadelphia. Issues for Sept., 1915 (Unemployed); May, 1916 (Personnel Management); and May, 1917 (Reducing Labor Turn-Over).

Schulze, J. William, *Office Administration:* New York. McGraw-Hill Book Co., 1919.

Scientific Management (Addresses and Discussion). Hanover, N. H. Amos Tuck School, 1912.

Stoddard, Wm. L., *The Shop Committee:* New York. Macmillan, 1919.

Taylor, Frederick W., *The Principles of Scientific Management:* New York. Harper & Bros., 1913.

Taylor, Frederick W., *Shop Management*: New York. Harper & Bros., 1911.

Tead, Ordway, *Instincts in Industry*: Boston. Houghton Mifflin, 1918.

Thompson, C. Bertrand, *Scientific Management: (Collection of the more significant articles).* Cambridge. Harvard Univ. Press, 1914.

Thompson, C. Bertrand, *Theory and Practice of Scientific Management*: Boston. Houghton Mifflin, 1917.

Thompson & Lichtner, *Development of Scientific Methods of Management in a Manufacturing Plant:* Boston, 136 Federal St. Thompson & Lichtner Co., 1917.

EXCERPTS

"THERE is clear necessity that, in this day of unrest and revaluation, the leaders of American business and industry face fresh problems with fresh minds. The real center of social authority has so far shifted from politics to industry that the tone and temper of our national life are more nearly determined by the way the business and industry of the country are conducted than by the way the government is conducted. The statesmanship or stupidity of business men is of more social significance than the statesmanship or stupidity of politicians." (Glenn Frank, *The Politics of Industry*, p. V).

"NOW, what are a few of the principles that, combined, must form and under all circumstances include both the employers' point of view, viz. good profits, with the employees' point of view, high wages and reasonable hours? The chief of these basic principles are increased production with consequent reduction of overhead charges and reduced operating costs, combined with shorter hours for workers, resulting in better working conditions, leading to greater efficiency and producing higher wages and better profits. To ensure the attainment of these aims and objects and of these sound economic conditions, and as part of the control of labour, the words 'Scientific Management' have been applied. Unfortunately, much that is preached and sometimes practiced by this school of employers is neither scientific nor worthy of the name of management. But underlying all the error of this school of thought are some good, sound, wholesome practices. But perhaps a less stilted and less irritating title would be 'Industrial Administration.' The supreme spirit of scientific management worthy of that description must be that of administration. 'Management' rarely considers the workman other than from the point of view of control, and to thrust the antagonizing spirit of control to the front place, as so-called 'Scientific Management' would appear to be doing, is not to make the relations between employers and employees less irritating, but rather the contrary. The whole idea associated with 'Management' is that of control, which idea has embalmed itself, and its meaning, in the name 'boss.' But workmen have grown and developed much during the last quarter century, and are no longer blindly consenting to be 'bossed' or controlled as if they were children. Workmen have become responsible human beings, and claim some just and sane share in the management of their own lives and conditions. The workman today claims rights, and does not deny that the exercise of rights will bring with it the responsibility for the performance of duties, and these duties he is willing to undertake. But to show how inapplicable the word 'Management' is, it is obvious that you cannot have management of rights nor management of duties. To show the better applicability of the word 'Administration,' you can have administration of rights and administration of duties. Therefore, if employers and employees are to be brought to work together, and if all suspicion and distrust, not to say actual and active opposition, are to be abolished, then the idea of 'Management' as 'bossism' must be surrendered by the employer.

"At this point, I think I can read the tohughts of many in the room, who will be wondering whether I am advocating the surrender of all discipline in Industrialism. Nothing of the sort. There must now, and for all time, be authority and law in Industrialism as in the Army and as in all places where communities have to live and act and work together. Both employer and employee must agree fully and without reserve in this, otherwise Industrialism and the working together of an organized system for production would be impossible, and mankind would degenerate into a mob.

"We must have authority and law and due observance of discipline in the factory and workshop as on the steamship, and as for the nation and State. But do not let us confuse ourselves over this essential. The question is, Has the authority to be autocratic? If so, have your management as 'boss' and endeavor to make it as scientific as possible. Or shall the authority be democratic? In that case, let us adopt the description for the authority we must provide that best fits our aims and intentions, viz. administration. You will find that whilst the dictionary gives 'control' as one of the meanings of management, that word does not appear as one of the meanings of administration, but the words 'to direct,' 'to dispense'; and the word 'guardian' is given as the meaning of the word 'administrator.' These latter all form a good democratic basis and the necessity for authority, law discipline, and obedience, under these conditions, is at once admitted and can be accepted without humiliation or loss of self-respect, when 'bossism' even if called 'Scientific Management,' would raise a spirit of opposition founded on the resentment we all feel to that very idea when applied to ourselves.

"Scientific Administration we would all welcome as applying to established principles supporting the laws for the working together of hundreds, or thousands, or millions of men and women in productive enterprises for the combined benefit of employers, employees, and of the whole community. Scientific Management is apt to be viewed as entirely designed to increase the profits and advantages of the employer at the expense of the employee, whereas Scientific Administration would be welcomed as merely the science of production in the simplest, easiest way which would secure the highest wages and the greatest prosperity for employers and employees. Scientific Administration can be honestly based on the assumption that the interests of employers and employees are identical and opposition thereto can only be possible on the assumption of the obvious error that these interests never can be honestly identical." (Lord Leverhulme, *The Six-Hour Day*, pp. 250-253).

"SO industrial goodwill is a valuable asset like commercial goodwill and good credit, and becomes so, more and more, in proportion as laborers acquire more liberty, power, intelligence and more inclination to assert their liberties. It too is valuable because it brings larger profits and lifts the employer somewhat above the level of competing employers by giving him a more productive labor force than theirs in proportion to the wages paid. And this larger profit reflects itself in the larger value of stocks and bonds, the higher capitalization of the going business. Goodwill is the expectation of future profit, and whether it be the commercial goodwill of patrons and customers, or the credit goodwill of bankers and investors, or the industrial goodwill of laborers, it has its present market value, sometimes greater than the value of all the tangible property of the business. Indeed, without goodwill, the tangible property is a liability rather than an asset." (Commons, *Industrial Goodwill*, p. 26).

"WHAT brought western Europe and America to the present level of material welfare, as the Bolshevik leaders well know, being adepts at economic history, were mainly three forces, all of which the Soviet Republic proposes to dispense with. They are the practice of private thrift with the consequent accumulation of capital; the pursuit of profits, with the consequent intense application of intelligence to the problems of market organization and the utilization of improved processes of production; and pecuniary emulation in the non-propertied classes, which offered the means of labor discipline, such as we know it."

". . . we are not content with existing conditions and we know of no one so fatuous as to be content with them. But they are susceptible of improvement in ways that involve no sacrifice of the values that have been won through centuries of struggle. We do not wish to sacrifice 'bourgeois' personal freedom; we wish to see it universalized. We do not wish to sacrifice the economic security that attaches to the possession of property. We wish to extend economic security to labor as well. We do not wish to reduce the scope of individual initiative, the control of the business organizer over his own fate. We wish to enlist labor in the work of control; we wish the counsel and will of labor to play upon the problem of the fate of a business and the prosperity of its personnel." (*The New Republic*, XIX, pp. 264 and 265).

MISS TEN-A-WEEK'S PLEA[1]

Not in devising a System
Do the Fearful Dangers lurk,—
Not in devising a System,
But in making the System work.

And the working-out of the System
Is not in the hands of the Great,
But rests on the shoulders of poor little clerks,
Like Johnny and Mary and Kate.

So, to the Men who are Higher Up,
This is a meek little prayer;
When the Conference Light is Burning,
And the Mighty are gathered there,
And they think of a WONDERFUL SYSTEM
That is manifold, intricate, neat—
(and full of unparalleled terrors
for little Miss Ten-A-Week's Feet)
May the Merciful Spirit that softens
The lot of the Little in Pay,
Be given a Voice and a Substance,

And this to the Great Ones say:
Not in devising a System
Do the Fearful Dangers lurk,—
Not in devising a System,
But in making the System work.

And the working-out of the System
Is not in the hands of the Great,
But rests on the shoulders of poor little clerks,
Like Johnny and Mary and Kate.

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[1] By a young lady in the plant of a member of the society.

ON THE PRACTICE OF ENGINEERING

It is doubtful whether engineering has been practiced as a profession to a point where definite codes of ethics and cannons of practice are possible. Certainly management engineering as a branch of engineering practice has not. In the effort to supply what may be looked upon as an interim standard, the Board of Directors has approved the following statement in spirit, pending a time when there can be presented to the Society an adequate code born of our own experience.

A MANAGEMENT ENGINEERS' CREED

The sublimest duty of the engineer is to keep the faith:

The faith of the client that he will not undertake what he knows to be beyond his ability, and that with respect to what he undertakes he will give conscientious service to the limit of his ability;

The faith of his fellow engineers that he will remain true to his science and will magnify and not cheapen it; and that he will base his efforts for public recognition upon ability, scientific attainment and actual performance, and not upon ambiguous self-laudation;

The faith of the community that he will undertake no service inconsistent with the public welfare; and that in service consistent with the public welfare, but in which the interests of groups appear to come in conflict, he will judge carefully and sympathetically the claims of rival interests, and attempt to establish that unity of purpose which promotes the public welfare.